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The efficacy of Diet Therapy vs. Pharmacological Treatment (Medicine) in Adults with Type 2 Diabetes: A Systematic Review

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Abstract

Type 2 diabetes mellitus (T2DM) is a global public health challenge characterized by insulin resistance and β-cell dysfunction, potentially leading to increased morbidity and mortality.
A systematic review was conducted following the PRISMA 2020 guidelines. Five electronic databases (PubMed, CINAHL, Cochrane Library, Web of Science, and Google Scholar) were searched for peer-reviewed studies published between 2019 and 2025. Eligible studies included randomized controlled trials, controlled clinical trials, and quasi-experimental studies involving adults with T2DM. Outcomes assessed included glycated hemoglobin (HbA1c), insulin sensitivity, weight, lipid profiles, blood pressure, and medication use. Methodological quality was evaluated using the Academy of Nutrition and Dietetics Evidence Analysis Library (EAL) criteria. The aim was to evaluate the efficacy of dietary therapy compared with pharmacological treatment in improving metabolic outcomes among adults with T2DM.

A total of 11 studies met the inclusion criteria. Dietary interventions, including fasting-based strategies, carbohydrate-restricted diets, plant-based diets, and structured nutrition therapy, consistently improved glycemic control, insulin sensitivity, and weight management. Significant reductions in HbA1c and cardiometabolic risk markers were observed across multiple studies. Remission rates for T2DM ranged from approximately 28% to 54%. Improvements in insulin resistance and β-cell function were identified as key mechanisms underlying metabolic recovery.

Findings support the integration of structured nutrition therapy into standard diabetes care. Early implementation of dietary interventions may enhance the likelihood of reversing metabolic dysfunction and reducing long-term dependence on pharmacological treatment.

Keywords: Type 2 diabetes mellitus, diet therapy, glycemic control, insulin sensitivity, HbA1c, diabetes remission

1. Introduction

Type 2 diabetes mellitus (T2DM) is a progressive metabolic disorder resulting from a combination of insulin resistance and pancreatic β-cell dysfunction (Galicia-Garcia et al., 2020). T2DM is among the most prevalent non-communicable diseases globally, impacting around 500 million individuals as of 2021 (Sun et al., 2022). By 2045, this figure is anticipated to exceed 700 million (International Diabetes Federation [IDF], 2021). T2DM is a meaningful challenge for individuals, families, and healthcare systems, since diabetes mellitus increases the likelihood of cardiovascular illness, renal failure, visual impairment, and lower limb amputation (World Health Organization [WHO], 2021; Arokiasamy, Salvi & Selvamani, 2020).

The primary treatment of T2DM is to achieve and maintain optimal glycemic control, often assessed using glycated hemoglobin (HbA1c), fasting blood glucose, and postprandial glucose levels (American Diabetes Association [ADA], 2023). Maintaining blood sugar levels within appropriate limits is crucial for reducing the risk of microvascular complications such as retinopathy, nephropathy, and neuropathy, as well as macrovascular issues, including stroke and myocardial infarction (Crasto, Patel, Davies & Khunti, 2021). Therefore, controlling T2DM is important to prevent complications.

Palmer et al. (2021) and Davies et al. (2018) indicate pharmaceutical agents such as Metformin, sulfonylureas, sodium-glucose co-transporter-2 (SGLT-2) inhibitors, glucagon-like peptide-1 receptor agonists (GLP-1 RAs), and insulin are typically initiated based on glycemic levels and additional health conditions. Medications can effectively reduce blood glucose levels; however, each require prolonged use and induce adverse effects such as hypoglycemia and abdominal discomfort, increasing the cost of therapy (Buse et al., 2020; Mohiuddin et al., 2019).

Over the past two decades, dietary therapy has emerged as a non-pharmacological intervention capable of regulating blood glucose levels and, in certain instances, perhaps reversing T2DM. Low-calorie, low-carbohydrate, ketogenic, and plant-based diets have been demonstrated to improve HbA1c, body weight, and insulin sensitivity (Lopes et al., 2021; Lean et al., 2018; Hallberg et al., 2019). The DiRECT experiment demonstrated rigorous calorie restriction resulted in remission for about fifty percent of individuals with T2DM after one year. This demonstrates dietary modifications may prevent the condition from exacerbating (Lean et al., 2018). Despite conflicting findings, pharmaceutical management remains the predominant therapeutic approach due to its rapid efficacy, ease of prescribing, and the perception patients are more likely to adhere to medication administration

(Al-Sahouri, Merrell & Snelgrove, 2019). This raises the question of whether dietary therapy alone could be equally effective or superior to pharmacological interventions in managing blood glucose levels, particularly in the first phases of T2DM.

The objective of this systematic review is to determine the efficacy of dietary interventions compared with pharmacological treatments in individuals with T2DM.
The review will contribute to the growing body of research endorsing lifestyle modifications as a method for managing T2DM. The review may also influence future guidelines and clinical decision-making processes for the management of illness.

2. Method

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) Guidelines were employed to ensure methodological transparency, reproducibility and comprehensive reporting of this systematic review (Page et al., 2021). This review sought to synthesize current evidence on the comparative effectiveness of dietary interventions and pharmacological treatments in the management of T2DM, with particular emphasis on glycemic control, medication adherence, self-management behaviors and treatment outcomes. This section delineates the selection and analysis of the included studies, encompassing their registration, the formulation of the search strategy, the establishment of eligibility criteria, data extraction, and quality assessment.

2.1 Protocol and Registration

As noted above, the PRISMA Guidelines guide clarity and prevent duplication of efforts. The systematic review methodology has been registered in the International Prospective Register of Systematic Reviews (PROSPERO) – CRD420251085085. The protocol served as a guide throughout the review process to minimize methodological bias and ensure consistency in study selection and analysis.

2.2 Search Strategy

A comprehensive and systematic literature review was conducted by the primary author across five databases to identify relevant studies examining the effects of dietary interventions on glycemic control, insulin sensitivity, medication use, and remission-related outcomes among T2DM. Electronic database searches were conducted independently by the primary reviewer across five major health and biomedical database: PubMed, CINAHL (EBSCO), the Cochrane Library, Web of Science, and Google Scholar. The initial search was performed in July 2025 and updated in January 2026 to identify newly published studies and ensure currency of the evidence base.

The search strategy was developed using the Population, Intervention, Comparator, and Outcome (PICO) framework. Both Medical Subject Headings (MeSH) and free-text terms related PICO were used in the search (see Table 1). Synonyms and alternative spellings were incorporated to improve sensitivity. Boolean operators (AND, OR, NOT), phrase searching, truncation and database-specific filters were employed to construct search sentences and enhance results.
The search terms were organized around three major concepts:

1. Population: Adults with Type 2 Diabetes Mellitus

2. Intervention: Diet therapy and dietary remission strategy
3. Outcomes: Glycemic control, medication adherence, insulin sensitivity and treatment outcomes

Boolean operators, phrase searching, truncation, wildcard symbols, and database-specific filters were used to combine search terms and optimize retrieval. Search strings were adapted to the indexing requirements and search functionalities of individual databases.

Table 1. Search Terms and Keywords

Key Words MeSH Terms to describe the population	Key Words MeSH Terms to describe the intervention	Key Words MeSH Terms to describe the outcome
Type 2 diabetes	Diet therapy/ Dietary intervention/Dietary remission strategies	Medication adherence
patients with T2DM	Plant based diet	HbA1c, Glycemic control, Glycated Hemoglobin A
Diabetes Mellitus, Type 2	Low calorie diet/ balanced diet	Weight, insulin sensitivity
Adult diabetes	Ketogenic diet	Treatment outcomes/Usual care

An example of the search strategy used was

"Type 2 OR Type 2 Diabetes, OR Type II Diabetes, NOT Gestational Diabetes AND Diet therapy, OR Low-calorie diet OR Dietary remission strategies, OR Plant-based diet OR Ketogenic diet AND Pharmacologic treatment OR Medication adherence Glycated Hemoglobin A OR Glycemic Control or HbA1c OR Insulin sensitivity OR Weight NOT Diabetes Mellitus, Type 1".

Reference lists of all eligible studies were manually searched to identify additional studies that may not have been captured through electronic database searching.

2.3 Eligibility Criteria

Eligibility criteria were established to ensure included studies were directly relevant to the research question and provided high-quality evidence on the comparative effectiveness of diet therapy and pharmacological treatment in adults with T2DM. The criteria were informed by the PICO framework (Population, Intervention, Comparator, Outcome) and were applied consistently throughout the screening and selection process. The PICO framework was employed to determine eligibility criteria. It included age and gender of participants, and also the setting or country in which the study was conducted. The health status considered is the T2DM, with the intervention being the diet therapy or dietary remission strategies. The outcome focused on self-management behaviors, HbA1c, glycemic control, medication adherence, and treatment outcomes. The study designs included randomized control trials, controlled clinical trials, and quasi-experimental studies with at least 10 participants per group. Peer reviewed, full text materials in English in the period between 2019 and 2025 were searched (see Table 2).

Table 2. Inclusion/exclusion criteria

Criteria	Inclusion	Exclusion
Age	Adults ≥18 years diagnosed with T2DM	Children or adolescents (<18 years)
Gender	All genders	None excluded based on gender
Setting / Country	Any country, if healthcare system/context is described	None, unless setting is unclear or irrelevant to T2DM care
Health Status / Problem / Condition	Diagnosed with Type 2 Diabetes Mellitus (T2DM)	Type 1 Diabètes, gestational diabetes, pre-diabetes
Intervention / Exposure	Diet therapy, Dietary remission strategies	Studies not measuring patient dietary outcomes or self-management
Outcome	Self-management behaviors, HbA1c, glycemic control, medication adherence, treatment outcomes	Studies not measuring medication adherence or treatment outcomes
Study Design Preferences	RCTs, controlled clinical trials, quasi-experimental	Case reports, editorials, narrative reviews, clinical reviews, protocols only
Size of Study Groups:	At least 10 participants per group	Fewer than 10 participants in any arm
Language	English only	Non-English without translation
Publication Year Range	2019–2025 (Last 6 years)	Before the last six years
Publication type	Peer-reviewed, full-text available	Conference abstracts only, dissertations, or posters

2.4 Data Extraction

The data extraction was undertaken using the Joana Briggs Institute (JBI) standardized data extraction tool (Aromataris et al., 2015). A structured extraction form was developed and used utilized for data extraction. The subsequent data collected included study title and author, year of publication and country, study design and setting, participant demographics (age, sex, diagnosis criteria), details of intervention (type of diet) and comparator (medication), duration of follow-up, primary and secondary outcomes (HbA1c, weight, insulin sensitivity), key findings, and limitations.

2.5 Quality Criteria Checklist

The Academy of Nutrition and Dietetics Evidence Analysis Library (EAL) Quality Criteria Checklist for primary research was used to assess the methodological rigor and risk of bias in all examined studies (Academy of Nutrition and Dietetics Evidence Analysis Library, 2022). The EAL Quality Criteria Checklist is validated appraisal tool widely used in nutrition and dietetics research to evaluate the internal validity, methodological rigor, and overall credibility of primary research studies. This instrument evaluates the selection bias, comparability of groups, blinding procedures, appropriateness of outcome measures, validity of statistical analysis, and funding bias. Each study received a quality rating: positive, negative, or neutral. A positive quality rating was assigned to studies that demonstrated a robust methodological design, minimal bias, and valid outcome measures and appropriate statistical analyses. A neutral quality rating was assigned to studies that met most methodological standards but exhibited minor limitations that were unlikely to substantially compromise the validity of the findings. The attributes show that the study has an acceptable design, minimal bias, and limited adjustment for confounding variables. The negative quality rating was assigned to studies demonstrating significant methodological weakness that could compromise the validity and interpretability of the results. Such weakness included inadequate study design, substantial risk of selection or measurement bias, poor control of confounding variables, inadequately described statistical analyses, and high attrition rates without appropriate handling. Evidence from negatively rated studies is interpreted with caution due to concerns regarding internal validity and generalizability (Aromataris & Munn, 2020).

2.6 Data Synthesis

Due to the anticipated heterogeneity in study designs, dietary interventions, outcome measures, and follow up periods, findings were synthesized narratively. This involved:

1. Grouping studies according to dietary intervention type
2. Comparing intervention effects on HbA1c, medication adherence, insulin sensitivity and weight outcomes
3. Examinig similarities and differences across studies
4. Assessing the consistency of findings across settings and populations
5. Considering study quality when interpreting outcomes

Where sufficient homogeneity existed among studies reporting similar interventions and other outcome measures, qualitative comparisons of effect sizes were examined.

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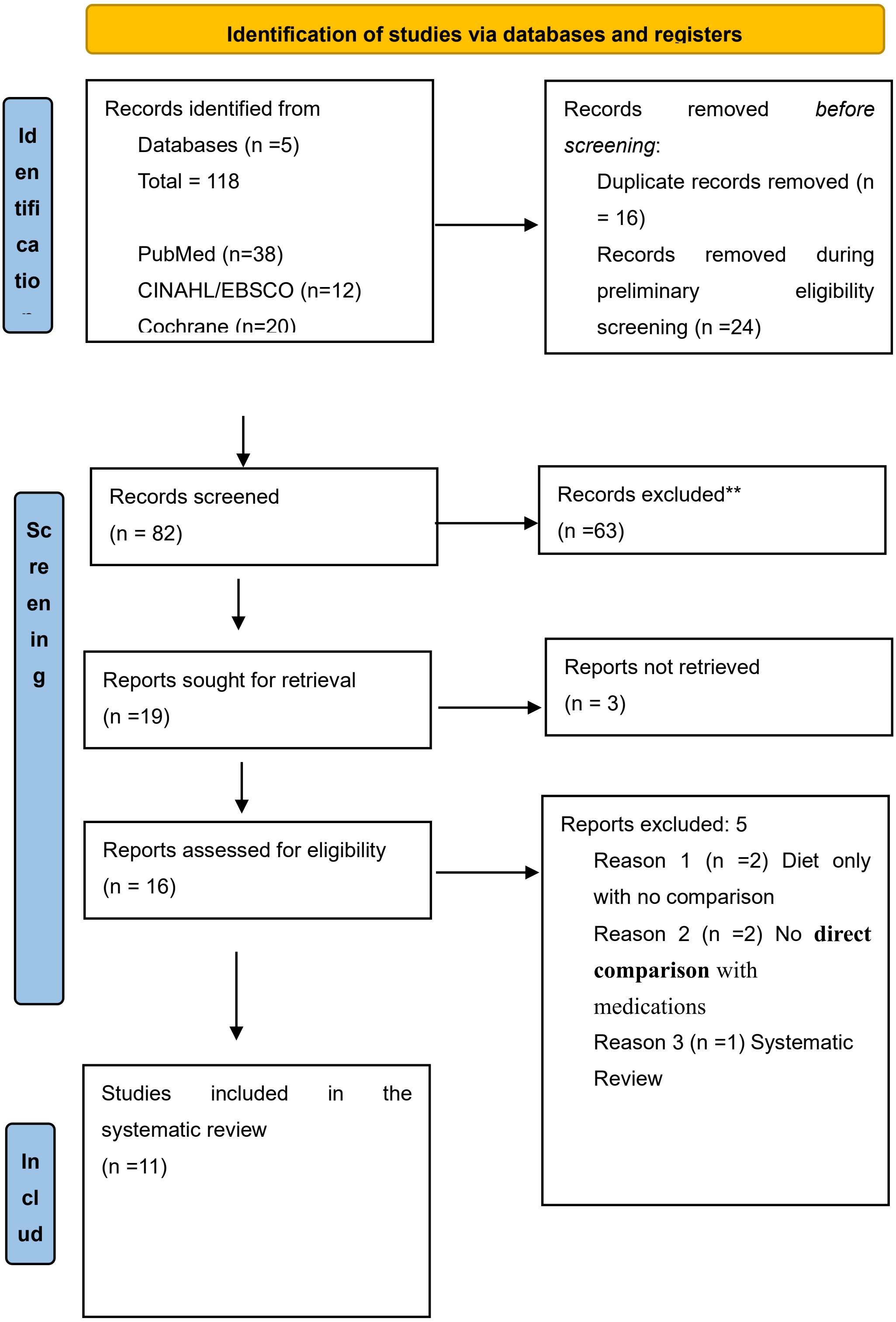
PRISMA Flow Chart



3. Results

This review included a search of five databases, yielding 118 related articles. Of the 82 records screened, 63 were excluded due to duplication and records removed during preliminary eligibility screening, and 19 were sought for retrieval. Three articles could not be retrieved, and 16 articles were evaluated for eligibility, of which five were excluded for various reasons noted in the PRISMA Flowchart. A total of 11 articles were therefore included in this study. Participants were adults with T2DM, and typical inclusion criteria across studies included ages 18 to 80 years, body mass index (BMI) greater than or equal to 25 to 30 kg/m^2, and HbA1c greater than or equal to 6.5%. This study investigated dietary lifestyle and combined pharmacologic-dietary interventions for the management and remission of T2DM.

3.1 Interventions

The studies included a variety of non-pharmacological and combination therapy strategies aimed at improving glycemic control and attaining remission of T2DM. The interventions were divided into five groups, namely, fasting/energy-restriction methods, macronutrient-composition diets, structured nutritional therapy and education, pharmacologic-dietary combination therapy, and lifestyle management.

3.1.1 Fasting and Energy-Restriction Interventions

Numerous researchers employed interventions that primarily altered caloric intake and the timing of food consumption, rather than the macronutrient composition of the diet (Van den Burg et al., 2024; Pavlou et al., 2023; Guo et al., 2024; Liu et al., 2025). A fasting-mimicking diet (FMD) was administered to 100 adults with T2DM (51 in the intervention group; 49 in the control group), comprising 5-day low-calorie cycles repeated monthly over a 12-month period in a primary-care randomized controlled trial (Van den Burg et al., 2024). During the fasting phase, individuals adhered to a restricted diet, whereas at other times, participants maintained their usual eating habits. The FMD group exhibited a significant ($p = 0.04$) reduction of 3.2 mmol/mol (0.3%) of HbA1c levels. The FMD group also experienced a significant ($p < 0.001$) weight reduction of 3.6 kg, with significant decreases in fasting insulin and triglycerides ($p = 0.01$ and $p = 0.04$, respectively). A 40% significant ($p < 0.001$) reduction of diabetes medication use was observed in the FMD group compared with only 5% in the control group; however, no significant ($p=0.18$) difference in safety issues were noted between the groups. Pavlou and colleagues (2023) conducted a three-arm randomized controlled study assessing time-restricted eating (TRE), in which 75 adults (25 per group) consumed meals solely within an 8-hour daily feeding window, without rigorous calorie monitoring, for six months. This was a parallel-group randomized controlled trial that employed between-group comparison. The HbA1c decreased significantly ($p < 0.001$) from 7.9% to 6.4%, and the individual's weight diminished significantly ($p < 0.0001$) from 103.6 kg to 89.8 kg. The mean glucose had a notable decrease from 9.8 to 6.2 mmol/L ($p < 0.001$), while HOMA-IR also decreased substantially ($p = 0.002$). The lipid profile indicated a significant reduction in triglycerides from 2.1 to 1.3 mmol/L ($p = 0.004$), significant elevation in HDL ($p = 0.03$), and non-significant increase in LDL ($p = 0.07$). Overall, 54% of the participants attained a HbA1c level of less than 6.5% without pharmacological intervention.

Fasting and energy- restriction interventions demonstrated substantial success in improving glycemic control, reducing medication dependence, and enhancing cardiometabolic markers.

A multicenter randomized clinical trial evaluated the effects of intermittent fasting on a 5:2 schedule combined with meal replacement in newly diagnosed T2DM patients. The intervention was compared with standard pharmacological treatments, including Metformin and Empagliflozin. The study enrolled 405 participants with early-stage T2DM and followed participants for 16 weeks, with an 8-week follow-up (Guo et al., 2024). This was a multicenter randomized controlled trial with a three-arm comparison. The findings demonstrated a substantial decrease in HbA1c within the fasting group ($p < 0.001$), whereas the intergroup difference in weight loss was not statistically significant ($p = 0.23$), suggesting remission was not only influenced by weight loss. A significant ($p = 0.04$) reduction in HOMA-IR was observed with the SGLT2 inhibitor, accompanied by an enhancement in the disposition index for beta cell function. Nonetheless, no significant change ($p = 0.86$) was noted in the triglycerides and LDL (Guo et al., 2024). The very low-calorie ketogenic diet (VLCKD) was a more stringent method for caloric restriction. The VLCKD diet offers participants fewer than 800 kcal daily and gradually reintroduces meals. This was a retrospective cohort comparison study assessing 30 participants (15 on VLCKD and 15 on LCD) during a 12-month duration. The HbA1c decreased by -0.61% ($p < 0.001$), accompanied by an 11.5% reduction in weight ($p < 0.001$). A substantial decrease in BMI ($p < 0.0001$), a drop in systolic blood pressure of approximately 13.7 mmHg ($p = 0.04$), an enhancement in diastolic pressure ($p = 0.03$), and an elevation in HDL ($p < 0.05$) were seen.

In a retrospective cohort comparative study, the total cholesterol decreased markedly, and 26.6% of participants ceased all antidiabetic medications (Moriconi et al., 2021). Collectively, this supports the emerging paradigm that structured nutritional therapies can serve not only as adjuncts but, in selected cases, as likely primary strategies for achieving glycemic remission and reducing pharmacological dependence in early-stage T2DM.

3.1.2 Macronutrient-Composition Diets

An alternative intervention involved diets focused on macronutrient composition, including the restriction of carbs. A carbohydrate-restricted diet, comprising around 9% of energy from carbohydrates and an increased fat intake, was evaluated against a higher-carbohydrate diet in participants with T2DM (Gower et al., 2024). This trial investigated the metabolic consequences of carbohydrate restriction without pharmaceutical intervention. The randomized controlled experiment ($n = 57$; compared participants on a carbohydrate-restricted diet with those on a higher-carbohydrate diet) assessed a carbohydrate-restricted diet (9% carbohydrate, 65% fat) versus a higher-carbohydrate diet (55% carbohydrate) over 12 weeks. In terms of glycemic outcomes, the low-carbohydrate group exhibited a significant ($p = 0.005$) reduction in HbA1c, a significant ($p = 0.03$) lowered fasting glucose level, and a notable ($p = 0.045$) decrease in fasting insulin. The insulin sensitivity index showed improvement ($p = 0.02$), and the low-carb group experienced a more significant weight loss ($p = 0.04$). Triglycerides were significantly reduced ($p = 0.01$), along with significant ($p = 0.04$) elevations in HDL levels. However, LDL readings were not statistically significant ($p = 0.12$). Deledda and researchers (2022) conducted a randomized pilot study ($n = 11$) comparing a ketogenic low-carbohydrate Mediterranean diet with a typical Mediterranean diet in drug-naïve diabetic participants. The glycemic results indicated a decrease in HbA1c in both groups, with a more significant drop observed in the ketogenic group ($p < 0.001$), and a significant reduction in fasting glucose was also noted ($p < 0.01$).

The HOMA-IR for insulin resistance significantly improved ($p = 0.02$), accompanied by a considerable weight loss ($p < 0.0001$) and a reduction in waist circumference ($p = 0.001$). An examination of the lipids indicated a marked reduction in triglycerides and an elevation in HDL levels ($p < 0.001$ and $p = 0.04$, respectively), whereas LDL was not significantly ($p = 0.17$) improved. A moderate reduction in blood pressure was seen; however, not statistically significant ($p \geq 0.09$, respectively for systolic and diastolic blood pressure). The findings demonstrated macronutrient-focused dietary strategies can produce significant improvements in glycemic control, insulin sensitivity, body weight, and lipid profiles, supporting their role as effective non-pharmacological approaches in the management of T2DM.

A randomized controlled trial with 30 participants, assigned to intervention and comparator groups, using a calorie-restricted diet showed metabolic improvements compared with standard care. The intervention of a very low-calorie diet (compared with standard care and alternative interventions, including pharmacological therapy) resulted in a substantial decrease in HbA1c ($p < 0.001$) levels. The fasting glucose level considerably dropped ($p < 0.001$), indicating enhanced hepatic glucose control and insulin sensitivity subsequent to dietary intervention. The intervention group exhibited a considerably larger weight decrease ($p < 0.0001$). A substantial decrease in fasting insulin ($p = 0.004$) and HOMA-IR ($p = 0.008$) was seen. The lipid profile indicated a significant reduction in triglycerides and LDL ($p = 0.03$ and $p = 0.04$, respectively), but HDL cholesterol exhibited no statistically significant change ($p = 0.12$) (). A significant finding highlighted by Anyiam et al. (2024) was the remission of diabetes. HbA1c levels of < 6.5% without pharmacological intervention was attained in a much greater percentage of individuals in the intervention group ($p = 0.01$). Notwithstanding variations in food content, both dietary models led to enhancements in glycemic control, lipid profiles, and weight, indicating that both carbohydrate restriction and enhanced dietary quality can affect glucose metabolism.

3.1.3. Structured Nutrition Therapy and Diabetes Education

Some studies focused on behavioral and clinical nutrition management rather than prescribed dietary patterns (Velázquez-López et al., 2022; Mirahmadizadeh et al., 2020). Diabetes education integrated with medical nutrition therapy (DE + MNT) was assessed in patients visiting public clinics. This observational cross-sectional study ($n = 395$) evaluated compliance with DE + MNT. The findings indicated participants who adhered to both diabetes education and medical nutrition therapy achieved a lower mean HbA1c of 7.7%, compared with a mean HbA1c of 8.7% among participants who did not adhere to the interventions, and this was statistically significant ($p = 0.003$). The HDL exhibited a slight enhancement ($p = 0.03$), triglycerides also demonstrated improvement ($p < 0.01$), however LDL did not reveal any significant ($p = 0.41$) reductions. In terms of physical activity, exercise adherence was observed with an odds ratio of 2.1 (95% CI 1.1 – 4.2); however, causality cannot be determined due to the cross-sectional design (Velázquez-López et al., 2022). An urban primary healthcare cohort examined the adherence of individuals to recommended lifestyle modifications, including food, medication, and exercise. This extensive cross-sectional study ($n = 700$) assessed medication usage, adherence to the Mediterranean diet, and levels of physical activity. The study found significant associations between adherence behaviors and improved glycemic control (HbA1c): Medication adherence ($p = 0.00$), adherence to the Mediterranean diet ($p = 0.00$), and adherence to physical exercise ($p = 0.001$). The demographic analysis revealed participants aged 50 to 64 exhibited the highest medication adherence ($p = 0.017$), while participants classified as overweight with a BMI of 25 to 29.9 kg/m^2 also showed significant adherence ($p = 0.008$).

This investigation revealed statistical correlations, rather than causal impacts (Mirahmadizadeh et al., 2020). The therapies focused on enhancing self-management strategies rather than imposing stringent dietary restrictions. Individuals who adhered to standardized educational and lifestyle guidelines demonstrated enhanced glycemic results.

3.1.4. Combined Nutritional and Pharmacological Therapy

Two randomized trials (Liu et al., 2025; Guo et al., 2024) assessed combination therapy, incorporating dietary change with pharmacological intervention. A multicenter, double-blind, randomized trial ($n = 328$; $n = 165$ intervention participants, $n = 163$ control participants) evaluated calorie restriction in conjunction with the SGLT-2 inhibitor Dapagliflozin. The primary outcome was remission of T2DM, observed at 44% compared to 28%, with a relative risk of 1.56 ($p = 0.002$), and a substantial drop in HbA1c ($p < 0.0001$) levels. The weight and systolic blood pressure had a significant ($p < 0.0001$) decrease of 5.0 kg vs 3.2 kg, respectively. This was a 1.8 kg reduction compared to the control (Liu et al., 2025). A unique multicenter randomized trial ($n = 405$) evaluated intermittent fasting meal replacement against conventional pharmaceutical treatments, such as Metformin and Empagliflozin. This study demonstrated a significant reduction in HbA1c ($p = 0.002$), with a T2DM remission rate of 59.6% compared to 28.1% ($p < 0.001$). Guo et al. (2024) noticed a weight difference of 9.7 kg across groups ($p = 0.28$), along with an enhanced beta cell function disposition index ($p = 0.01$) and HOMA-IR ($p = 0.04$). The study aimed to investigate the primary pathophysiological abnormalities of T2DM, including elevated hepatic glucose production and diminished renal glucose excretion. Combination therapy has shown significantly enhanced remission rates, insulin resistance, and cardiometabolic parameters relative to diet alone.

3.1.5. Dietary and Metabolic Function Studies

A comprehensive randomized experiment ($n = 183$) investigated glycemic remission determinants rather than a specific food protocol (Roncero-Ramos et al., 2021). Participants undergoing nutritional intervention for five years exhibited remission linked to maintained β-cell activity and reduced hepatic insulin resistance. The remission rate at five years was 40%, associated with a decreased HOMA-IR ($p = 0.008$), enhanced β-cell function ($p = 0.002$), reduced triglycerides ($p = 0.01$), and a lower baseline HbA1c ($p < 0.001$). Overall, the findings showed sustained resolution of hyperglycemia does not only rely on weight loss but by underlying metabolic restoration, especially improvements in β-cell function and insulin sensitivity, highlighting the importance of early, targeted interventions that preserve pancreatic capacity.

All studies implemented interventions comprising structured fasting protocols, carbohydrate-restricted diets, behavioral education programs, and combined drug-diet regimens. Despite the differing methodologies, each intervention aimed to reduce persistent hyperglycemia and enhance insulin sensitivity. The research suggests metabolic dietary adjustment and patient behavioral involvement are effective methods for enhancing T2DM outcomes.

3.2 Glycemic Control (HbA1c)

Glycemic control, primarily assessed via glycated hemoglobin (HbA1c), was the most documented result in several randomized control studies. Almost all interventions showed statistically significant drops in HbA1c, but the amount of change depended on the type, intensity, and length of the intervention (Van den Burg et al., 2024; Pavlou et al., 2023; Guo et al., 2024; Liu et al., 2025; Gower et al., 2024; Deledda et al., 2022; Anyiam et al., 2024).

Some other studies, a cross sectional study and a retrospective cohort comparative study also lends support to this (Velázquez-López et al., 2022; Moriconi et al., 2021). Across the studies, HbA1c reductions ranged from approximately -0.3% (fasting-mimicking diet) to about -0.9% in time-restricted eating interventions, with other studies reporting significant between-group differences (p-values ranging from $p = 0.04$ to $p < 0.001$) favoring intervention groups (Van den Burg et al., 2024; Pavlou et al., 2023; Liu et al., 2025; Guo et al., 2024). The fasting-mimicking diet, for instance, produced a modest ($p = 0.04$) but significant reduction of -3.2mmol/mol (~0.3%) (Van den Burg et al., 2024), whereas time-restricted eating resulted in a larger reduction ($p < 0.001$) from 7.9% to 6.4% (Pavlou et al., 2023). Similarly, pharmacologic- dietary combination therapy and intermittent fasting interventions demonstrated significant improvements ($p \leq 0.002$) in HbA1c compared with control or standard therapy (Liu et al., 2025; Guo et al., 2024). Nonetheless, numerous findings did not attain statistical significance for HbA1c improvement or failed to clearly demonstrate a distinction between groups (Van den Burg et al., 2024; Deledda et al., 2022). A cross-sectional study (Mirahmadizadeh et al., 2020), also lends credence to this. Although the magnitude of HbA1c reduction varied across intervention types and study designs, the overall pattern of evidence indicates that structured dietary and lifestyle interventions consistently achieve clinically meaningful improvements in glycemic control, with the greatest effects observed in more intensive or combined therapeutic approaches, thereby reinforcing their role as effective strategies in the management of T2DM.

3.3 Diabetes Remission

Many studies looked at diabetes remission, which is usually defined as HbA1c results below 6.5% without using any drugs to decrease blood glucose. Remission was evident not just by a unique dietary approach but also via pharmacologic-dietary combination therapy, stringent dietary intervention, and sustained lifestyle improvement. In a multicenter, double-blind, randomized controlled trial, individuals undergoing calorie restriction alongside the SGLT-2 inhibitor Dapagliflozin achieved remission in 44% of cases, in contrast to 28% in the calorie-restriction-only group (Liu et al., 2025). Even if pharmacological treatment makes remission more likely, the diet-only group had a high probability of remission. This suggests reducing calories can help restore glycemic control on its own.
Similarly, stringent dietary treatments resulted in remission even in the absence of pharmaceutical treatment. A dietary intervention study employing fasting and ketogenic approaches demonstrated approximately 54% of participants achieved HbA1c levels below the diagnostic threshold without pharmaceutical treatment (Pavlou et al., 2023). Participants demonstrated reduced dependence on insulin and metformin, highlighting that metabolic improvements were not solely pharmaceutical but reflective of improved endogenous glucose regulation.

A five-year randomized trial revealed ongoing dietary therapy resulted in remission for 40% of participants. The prolonged remission over several years demonstrated T2DM can attain a stable non-diabetic metabolic state when the underlying metabolic dysfunction is addressed, rather than being exclusively treated through pharmacological interventions.

3.3.1 β-Cell Function

Maintained pancreatic β-cell function was a critical marker of remission. Individuals who achieved remission exhibited significantly increased disposition index values, indicating improved insulin secretion capacity (Roncero-Ramos et al., 2021). The pancreas can better handle the influx of glucose when producing more insulin, keeping blood glucose levels stable without the need for drugs.

3.3.2 Insulin Resistance (Hepatic and Peripheral)

Decreased hepatic insulin resistance had a substantial correlation with remission. Remitters displayed significantly reduced HOMA-IR levels in contrast to non-remitters (Roncero-Ramos et al., 2021). Additionally, dietary interventions, such as fasting regimens and calorie restriction, improved insulin sensitivity metrics, signifying reestablishment of insulin responsiveness is essential for correcting hyperglycemia (Van den Burg et al., 2024; Guo et al., 2024).

3.3.3 Weight Loss and Adiposity

Weight loss helped with remission, but was not the sole determinant. Intermittent fasting and meal-replacement programs led to substantial weight loss; nevertheless, remission occurred even when weight fluctuations were similar between the intervention groups (Guo et al., 2024). These findings indicate improvements in metabolism, particularly reduced hepatic fat and increased insulin sensitivity, may be more consequential than simple decreases in total body weight.

3.3.4. Lipid and Metabolic Profile

Remission was associated with improved metabolic markers. People who went into remission had lower triglyceride levels and better insulin dynamics (Roncero-Ramos et al., 2021). Dietary interventions improved fasting insulin and lipid profiles, supporting the concept that remission indicates comprehensive metabolic recovery rather than only a drop-in glucose levels (Pavlou et al., 2023; Van den Burg et al., 2024).

3.3.5. Duration of Diabetes

Evidence indicated remission was more likely in those with early-stage diabetes. Patients with shorter sickness duration and reduced β-cell degeneration had higher remission rates (Roncero-Ramos et al., 2021). This suggests that the progression of T2DM is somewhat reversible before permanent pancreatic damage occurs.

Remission was achievable in approximately 28%–54% of patients, depending on the intervention's intensity and duration. The research consistently indicates remission is not merely a result of temporary glucose reduction but linked to the reestablishment of metabolic physiology, namely improved insulin sensitivity, sustained β-cell function, and reduced metabolic stress on the pancreas.

3.4.1 Weight Loss Outcomes

Nutritional interventions often resulted in substantial reductions in body weight. The amount of weight loss varied based on how strict the diet was, how long the diet lasted, and whether or not the person was also taking medication while making lifestyle changes.

The fasting-mimicking diet (FMD) led to an average weight reduction of around 3.6 kg during the intervention, which was statistically significant ($p < 0.001$) when compared to conventional care (Van den Burg et al., 2024). The decrease occurred despite preserving fat-free mass, signifying the intervention mostly reduced adipose tissue rather than lean tissue. This finding is clinically important since losing visceral fat is closely linked to better glucose metabolism. More intensive energy-restriction strategies led to greater weight loss. A 5:2 intermittent fasting meal-replacement plan produced an average weight loss of 9.7 kg, representing one of the most significant changes recorded in the examined study (Guo et al., 2024). The amount of weight loss reflects the substantial caloric deficit induced during fasting periods and was associated with concurrent improvements in insulin resistance and glycemic measures.

Time-restricted eating (TRE) did not require tight calorie management and yet led to clinically substantial reductions in body weight. During the intervention period, participants lost about 3.6% of their baseline body weight (Pavlou et al., 2023). This shows changing the timing of meals can change energy balance and metabolic management, even if there are no set calorie goals. The very-low-calorie ketogenic diet (VLCKD) led to the most significant relative weight loss (p value), with a decrease of roughly 11.5% in body weight over 12 months in a retrospective study (Moriconi et al., 2021). The ketogenic diet severely restricts carbohydrate intake to induce ketosis, promoting fat oxidation and diminishing hunger. Participants reported increased satiety and compliance relative to conventional low-calorie diets. Combination therapy also led to significant changes in weight. In the randomized experiment that combined calorie restriction with dapagliflozin, participants experienced an average weight loss of 5.0 kg, exceeding the weight reduction observed with dietary modification alone (Liu et al., 2025). The medication helps the body get rid of glucose in urine, which creates an extra calorie deficit.

3.4.2. Weight Loss and Diabetes Remission

Although weight reduction was frequently observed, it was not always the sole factor affecting normalization of glycemic control. In the intermittent fasting experiment, remission occurred in the absence of statistically significant weight differences between comparison groups, indicating improved glycemic control was not only dependent on body mass reduction (Guo et al., 2024). Longitudinal investigations showed remission was more strongly associated with increased β-cell activity and reduced hepatic insulin resistance than with body weight alone

(Roncero-Ramos et al., 2021). Fasting and ketogenic therapy improved insulin sensitivity measurements and lowered fasting insulin levels, signifying metabolic benefits beyond simple calorie restriction (Van den Burg et al., 2024; Pavlou et al., 2023). The studies suggested processes such as reduced hepatic fat, enhanced insulin sensitivity, and restoration of pancreatic function may be crucial for attaining remission. In summary, whereas weight loss significantly improves glycemic control, the evidence indicates that the remission of T2DM reflects a more extensive metabolic recovery rather than merely a consequence of weight reduction.

3.5.1 Insulin Resistance and Glucose Metabolism

Along with the drop in HbA1c, several studies looked at the basic parts of metabolic physiology, such as how sensitive insulin is, how much insulin is made, and how glucose is used. Dietary and combination therapy produced significant improvements in indicators of insulin resistance and pancreatic β-cell functionality (Anyiam et al., 2024; Gower et al., 2024; Guo et al., 2024; Liu et al., 2025; Roncero-Ramos et al., 2021).

3.5.2 Matsuda Index (Comprehensive Insulin Sensitivity)

Individuals adhering to a fasting-mimicking diet exhibited an improvement in the Matsuda index, a metric derived from glucose tolerance tests that reflects peripheral insulin sensitivity. The intervention significantly improved insulin sensitivity ($p = 0.02$) compared to usual care (Van den Burg et al., 2024). A higher Matsuda index equates to better uptake of glucose in skeletal muscle and other peripheral tissues. This suggests the intervention enhanced insulin effectiveness at the cellular level rather than only reducing blood glucose levels through caloric restriction.

3.5.3 HOMA-IR (Hepatic Insulin Resistance Assessment)

Consistent reductions in the Homeostatic Model Assessment for Insulin Resistance (HOMA-IR) were observed across diverse dietary strategies. The combination of calorie restriction and Dapagliflozin led to a much greater reduction ($p < 0.0001$) in insulin resistance compared to diet alone (Liu et al., 2025). Intermittent fasting and time-restricted meals improved insulin sensitivity, whereas ketogenic and plant-based therapy led to significant ($p = 0.002$ and $p = 0.008$) decreases in HOMA-IR values, respectively (Pavlou et al., 2023; Anyiam et al., 2024). HOMA-IR primarily signifies hepatic insulin resistance; hence, the findings imply an augmented inhibition of hepatic glucose synthesis. In T2DM, decreased hepatic glucose production is essential, as fasting hyperglycemia is mostly attributed to heightened hepatic gluconeogenesis.

3.5.4 β-Cell Function

Improvements in β-cell functioning were observed in trials assessing remission predictors and combination therapies. Participants receiving both dietary and pharmacological interventions exhibited significantly elevated disposition index values ($p = 0.01$), indicating increased pancreatic insulin production (Guo et al., 2024). Long-term follow-up data demonstrated participants achieving remission displayed preserved β-cell activity, in contrast to non-remitters (Roncero-Ramos et al., 2021). The data suggested metabolic therapy may alleviate glucotoxicity and lipotoxicity, enabling a partial restoration of pancreatic insulin secretion capacity rather than merely offering pharmacological compensation.

3.5.5 Fasting Insulin Levels

Several treatments demonstrated significant reductions in fasting insulin levels. The fasting-mimicking diet significantly decreased ($p = 0.01$) fasting insulin levels in comparison to control participants (Van den Burg et al., 2024). Lowering fasting insulin levels suggest insulin sensitivity has improved because lower insulin levels are needed to keep glucose levels normal. Similar reductions were observed following the introduction of plant-based dietary therapies and ketogenic-style approaches (Anyiam et al., 2024). The collective evidence demonstrated dietary modifications influence not only glycemic outcomes but also the underlying pathophysiology of T2DM. Observed improvements in peripheral insulin sensitivity, hepatic glucose regulation, pancreatic β-cell functioning, and basal insulin production indicate these interventions target fundamental metabolic dysfunctions associated with the disease, rather than merely reducing blood glucose through pharmacological mechanisms.

3.6.1 Lipid Profile

In addition to glycemic outcomes, several studies assessed cardiometabolic risk factors, particularly serum lipid profiles. Dietary and lifestyle changes improved several parts of the lipid profile, although the amount of improvement was different for triglycerides, HDL cholesterol, and LDL cholesterol (Anyiam et al., 2024; **Deledda et al.,** 2022; Guo et al., 2024; Liu et al., 2025; **Pavlou et al.,** 2023; Van den Burg et al., 2024).

3.6.2 Triglycerides

A consistent finding across several treatments was a significant reduction in triglyceride levels. Individuals following the fasting-mimicking diet demonstrated a statistically significant decrease ($p = 0.04$) in triglyceride levels compared to the control group (Van den Burg et al., 2024). Similarly, time-restricted eating and ketogenic dietary interventions led to substantial improvements in triglyceride levels (Pavlou et al., 2023). The same result was corroborated by Moriconi et al., (2021) in their retrospective cohort comparative study. The 5:2 intermittent fasting meal-replacement technique also lowered triglyceride levels, leading to calorie restriction, improving lipid metabolism (Guo et al., 2024). A plant-based dietary regimen significantly decreased ($p = 0.03$) triglyceride (Anyiam et al., 2024). In multiple studies, the decrease in triglycerides likely signified reduced hepatic fat synthesis and increased insulin sensitivity, both of which are closely linked to enhanced glucose regulation.

3.6.3 HDL Cholesterol

High-density lipoprotein (HDL) cholesterol generally increased following dietary interventions, especially those involving carbohydrate restriction, caloric restriction, and fasting-based eating patterns. The ketogenic and intermittent fasting strategies showed significant increases in HDL cholesterol ($p = 0.03–0.04$) (Pavlou et al., 2023; Deledda et al., 2022). The VLCKD regimen revealed a significant elevation ($p < 0.05$) in HDL cholesterol at the 12-month interval (Moriconi et al., 2021). Lifestyle-based interventions, which incorporated dietary modification alongside physical and behavioral changes, also resulted in modest improvements in HDL cholesterol. In the cross-sectional study by Velázquez-López et al. (2022), adherence to diabetes education and medical nutrition therapy was associated with a statistically significant increase in HDL levels ($p = 0.03$). These findings suggest both structured dietary interventions and broader lifestyle interventions, including exercise, contribute to improvements in HDL cholesterol. High HDL cholesterol is clinically important, facilitates reverse cholesterol transport, and associated with reduced cardiovascular risk since the biomarker is linked to better reverse cholesterol transfer and a lower risk of heart disease.

3.6.4. LDL Cholesterol

The effect on low-density lipoprotein (LDL) cholesterol varied between trials, unlike triglycerides and HDL. Some interventions showed small declines, while others showed no changes or very small increase. For example, ketogenic and carbohydrate-restricted diets did not cause any statistically significant changes ($p = 0.17$ and $p = 0.12$) in LDL cholesterol, but they did improve other lipid indicators (Deledda et al., 2022; Gower et al., 2024). During the time-restricted eating trial, LDL cholesterol showed a slight rise, although this change ($p = 0.07$) was not statistically significant (Pavlou et al., 2023). The results suggested limiting carbohydrates in the diet may mainly affect triglyceride metabolism and HDL cholesterol. On the other hand, LDL cholesterol did not always improve, even when blood sugar control and weight loss improved. The evidence collectively indicated dietary interventions in T2DM result in a cardiometabolic profile characterized by decreased triglycerides, increased HDL cholesterol, and variable responses in LDL cholesterol. Improvements in triglycerides and HDL were consistently associated with increased insulin sensitivity and glycemic control, although LDL cholesterol had inconsistent responses contingent upon dietary composition.

3.7 Blood Pressure

Several studies evaluated blood pressure as a secondary cardiometabolic outcome. Dietary and lifestyle interventions led to decreases in both systolic and diastolic blood pressure; however, the magnitude and statistical significance differed according to the kind of intervention and study design. In the multicenter randomized study that combined calorie restriction with dapagliflozin, participants demonstrated a significant reduction ($p < 0.0001$) in systolic blood pressure compared to the control group (Liu et al., 2025). The improvement

was linked to lower body weight and insulin resistance, which suggests that better regulation of the blood vessels and metabolism helped lower blood pressure. Similarly, the very-low-calorie ketogenic diet produced statistically significant reductions ($p = 0.04$ and $p = 0.03$, respectively) in both systolic and diastolic blood pressure (Moriconi et al., 2021). After 12 months, participants' systolic blood pressure dropped by about 13.7 mmHg, and their diastolic blood pressure dropped ($p \leq 0.04$) by a statistically significant amount (Moriconi et al., 2021). The data indicated stringent calorie restriction and carbohydrate reduction may improve vascular tone and reduce peripheral resistance.
Fasting-based methods have demonstrated beneficial outcomes. Intermittent fasting and time-restricted eating were associated with increased glycemic variability and weight loss, along with reductions in cardiometabolic risk factors such as blood pressure (Pavlou et al., 2023; Guo et al., 2024). Not every comparison reached statistical significance; however, the trend of change consistently favored the intervention groups. The pilot trial, Deledda and associates (2022), comparing the ketogenic and Mediterranean diets showed very minor drops in systolic and diastolic blood pressure, which were not statistically significant ($p \geq 0.09$). Lifestyle education programs demonstrated improvements in metabolic markers; however, they did not consistently produce significant changes in blood pressure (Velázquez-López et al., 2022).

The data indicated dietary interventions, particularly those entailing substantial calorie restriction or weight loss, typically lower systolic blood pressure, whereas small or behavioral interventions yield more limited effects. The difference in statistical significance is probably due to differences in the severity of the intervention, the baseline cardiovascular risk, and the sample size of the trials.

3.8 Medication Use

A notable treatment effect identified in various studies was the reduced reliance on glucose-lowering medication following nutritional modification. Numerous strategies have demonstrated metabolic control can be achieved with diminished pharmaceutical support, alongside the enhancement of biochemical indicators. In a primary-care randomized controlled trial, participants assigned to the fasting-mimicking diet demonstrated a notable decrease in medication utilization. Approximately 40% of individuals in the intervention group reduced their diabetes medications, compared to only 5% in the usual-care control group (Van den Burg et al., 2024). This decrease happened simultaneously with improved glycemic control, which revealed improvement was not due to stronger medicine but rather better regulation of glucose in the body. The very-low-calorie ketogenic diet, a more stringent dietary approach, has also demonstrated considerable pharmacologic de-escalation. After 12 months of the intervention, about 26.6% of patients were able to discontinue all antidiabetic medicines (Moriconi et al., 2021). Participants had lower levels of HbA1c and body weight at the same time, which suggested stopping the drug was clinically appropriate, not because the therapy was not effective.

Fasting and ketogenic therapy were also associated with a reduced dependence on insulin and oral medicines. During the time-restricted eating experiment, individuals showed a significant decrease in the need for insulin and metformin as glycemic control improved (Pavlou et al., 2023). The reduction in medication corresponded with improvements in glucose variability and insulin sensitivity, substantiating the hypothesis dietary modifications corrected underlying metabolic dysfunction. Research on combination therapy further substantiated this conclusion (Liu et al., 2025). Although pharmacological interventions increased remission rates, the diet-only groups still had substantial metabolic improvement, suggesting lifestyle modifications contributed to reduced pharmaceutical need.

3.9 Safety Issues

Safety outcomes were recorded in several randomized controlled trials, and generally, the dietary and combination therapy were well tolerated. Side effects were primarily moderate and comparable between the intervention and control groups (**Van den Burg et al., 2024; Liu et al., 2025;** Guo et al., 2024). In the randomized research of the fasting-mimicking diet, recorded side effects were minimal and occurred at similar frequencies in both the intervention and usual-care groups (Van den Burg et al., 2024). Participants effectively followed the fasting cycles without any clinically significant issues, indicating that the strategy is viable in a primary care setting under physician oversight. Similarly, a multicenter double-blind randomized study evaluating calorie restriction alongside dapagliflozin demonstrated a non-statistically significant ($p = 0.51$) increase in adverse events compared to the control group (Liu et al., 2025). The absence of further complications suggested integration of pharmacologic therapy with dietary adjustments did not compromise patient safety.

The intermittent fasting and meal-replacement regimen was well tolerated, with minimal or no changes in adverse events between treatment groups (Guo et al., 2024). Participants continuously complied with the experiment, and the strategy did not result in major metabolic anomalies despite substantial calorie restriction. Alternative dietary therapy, including ketogenic and time-restricted eating regimens, exhibited positive acceptability and adherence, with no notable safety concerns (Pavlou et al., 2023). Similar results were seen in the retrospective study by Moriconi et al., (2021). Even with close monitoring of metabolic parameters across several studies, no serious adverse events necessitating discontinuation of the intervention were reported. As a result, the randomized studies showed structured dietary interventions, such as fasting, limiting carbohydrates, or combining medications, are usually safe when done with the right supervision. The similar rates of adverse events in the intervention and control groups support the clinical efficacy of these techniques as therapeutic alternatives for T2DM.

3.10 Quality Assessment

Established categories of positive, negative, and neutral were used to evaluate the methodological quality of the studies (Chiavetta, Martins, Henriques, & Fregni, 2014). Of the eleven studies included in the review, six were evaluated as high quality, and five were graded as neutral quality. Primarily, data was derived from randomized controlled trials, hence augmenting internal validity; nevertheless, certain observational and pilot studies reduced the overall quality (Van den Burg et al., 2024; Liu et al., 2025; Pavlou et al., 2023; Guo et al., 2024; Gower et al.,2024; Anyiam et al.,2024). The **neutral quality studies** included Moriconi et al. (2021), Deledda et al. (2022), Velázquez-López et al. (2022), Mirahmadizadeh et al. (2020), and Roncero-Ramos et al. (2021). The studies generally had methodological constraints such as retrospective or cross-sectional designs, smaller sample sizes, or limited statistical reporting.

Table 3. Article Summary Table

	Reference	Sample and purpose	Study Design	Results	Quality Guide
1	Van den Burg et al., 2024	n=100 FMD group = 51, control = 49 Adults aged 18–75, BMI ≥27, T2DM with HbA1c ≥6.5%, metformin as the only medication Fasting-mimicking diet (FMD), 5-day cycles monthly Usual care (no dietary intervention) 12 months Primary: Changes in medication use and HbA1c after 12 months; Secondary: Weight, insulin sensitivity (Matsuda index), lipid profiles - FMD group had significant HbA1c reduction (−3.2 mmol/mol), while control showed little to no improvement.	Randomized Controlled Trial (Assessor-blinded) conducted in a primary care setting with general practitioners supervising intervention	- HbA1c reduction in FMD group: −3.2 mmol/mol (~0.3%) vs negligible in control (p=0.04). Medication reduction in 40% of FMD participants vs 5% in control (P<0.001). 53% of FMD group achieved improved glycemic management. Weight loss: −3.6 kg in FMD (p<0.001); preserved fat-free mass. Improved insulin sensitivity (Matsuda index) (p=0.02). Adverse events were mild and similar between groups. Intervention feasible in primary care setting with high adherence. Strong agreement that whole-food, plant-based diets can achieve remission of T2DM without medication. Fasting insulin - Reduction in FMD vs control with a statistically significant decrease. (p=0.01) Emphasis on intensity and adherence for success. Triglycerides - FMD group reduced TG levels significantly (p=0.04). Low-carbohydrate diets did not achieve consensus due to uncertainty about long-term safety. Liver enzymes (ALT) - Decreased in FMD group which was statistically HbA1c and weight loss did not show statistically significant differences between groups over 6 months, though trends favored the FMD group. Highlighted importance of multi-component interventions (diet, physical activity, behavioral therapy). Encouraged shared decision-making between clinicians and patients based on preferences and feasibility.	Positive (+) Random allocation and assessor blinding reduce selection and detection bias Valid and reliable outcomes (HbA1c, weight, insulin sensitivity) Intervention and comparator groups well described Statistical analysis sound Applicable to primary care, though generalizability may be limited to non-insulin users Risk of Bias: High due to retrospective nature and small sample size.
2	Liu et al., 2025	n=328 (165 intervention, 163 control)	Multicenter Double-blind RCT across 16 hospitals	Significantly greater reduction in HOMA-IR (−0.8), body weight (−5.0 vs −3.2 kg), and systolic BP in dapagliflozin group (p<0.0001) No significant difference in adverse	Positve (+) RCT design (randomization and double-blinding) minimizes bias and

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Reference	Sample and purpose	Study Design	Results	Quality Guide
	Aged 20–70, BMI >25, T2DM <6 yrs | Calorie restriction (500–750 kcal/day deficit) Dapagliflozin 10 mg/day vs placebo 12 months + 2-month post-treatment Primary: Remission (HbA1c <6.5%, FPG <126, no meds) Secondary: Weight, HOMA-IR, BP, lipids | - 44% remission in dapagliflozin + diet vs 28% with diet alone (RR 1.56, P=0.002).		events—tolerable and feasible strategy (p=0.51). Emphasizes synergy between modest calorie restriction and pharmacologic SGLT-2 inhibition. Not generalizable to T2DM >6 yrs or insulin users; some body composition outcomes not measured at all sites based on the eligibility criteria. Weight, insulin sensitivity (HOMA-IR), BP, lipids - 44% remission in dapagliflozin + diet group vs 28% with diet alone (p<0.0001). Diet alone still achieved high remission, demonstrating its independent effect (p<0.0001). Greater improvements in HOMA-IR, weight, lipids with drug + diet. Self-reported diet adherence; no comparison with diet-only/no drug in separate group (p<0.0001). Body weight loss: Dapagliflozin group lost 1.3 kg more than placebo group (p<0.0001). Insulin resistance (HOMA-IR) improved more significantly in the dapagliflozin group (−0.8 difference) (p<0.0001). Systolic blood pressure, waist circumference, body fat, and serum lipids improved more with dapagliflozin (p<0.0001). No significant increase in adverse events, suggesting combination therapy is safe and effective (p=0.51). Calorie restriction alone still achieved 28% remission, reinforcing diet's independent efficacy (p<0.0001). Not generalizable to non-obese patients or those with >6 years of T2DM; adherence self-reported; mobile app usage could bias adherence results. This RCT found that combining dapagliflozin with calorie restriction significantly improves the chances of remission in T2DM compared to placebo (p<0.0001). It is a well-conducted trial with robust statistical analyses, though the reliance on self-reporting for adherence could introduce bias	enhances internal validity. Adequate sample size and clear outcome measures with clinically relevant endpoints (e.g., HbA1c, weight loss). Long follow-up duration (12 months) and adequate statistical methods. No significant conflicts of interest. Weaknesses: Exclusion of participants on insulin or sulfonylureas limits the generalizability of the findings to a broader T2DM population.

	Reference	Sample and purpose	Study Design	Results	Quality Guide
3	Moriconi et al., 2021	n=30 (15 VLCKD, 15 LCD) Adults 35–75; obesity (BMI ≥27); T2DM with HbA1c ≤8.5%, VLCKD (<800 kcal/day, phased reintroduction), LCD (500–1000 kcal/day deficit), 12 months, HbA1c, weight, BP, lipids, medication use, - VLCKD led to 11.5% weight loss and −0.61% HbA1c reduction at 12 months.	Retrospective cohort comparative study; hospital endocrinology clinic	VLCKD led to 11.5% weight loss and −0.61% HbA1c reduction at 12 months ($p<0.001$). 26.6% of patients discontinued all antidiabetic medications. BP and cholesterol significantly improved (SBP ↓13.7 mmHg; total cholesterol ↓45 mg/dL) Systolic blood pressure reduced in both VLCKD ($p=0.04$). Diastolic blood pressure led to greater reduction in VLCKD ($p=0.03$). HDL cholesterol increased significantly in VLCKD ($p<0.05$). BMI reduction was greater in VLCKD group with a significance value of $p<0.0001$ LCD group showed no significant improvements in weight or HbA1c ($p<0.001$). VLCKD patients reported better satiety, faster weight loss, and higher adherence scores. Retrospective design; small sample; self-reported adherence; baseline therapy not standardized VLCKD is significantly more effective than LCD for glycemic control, weight loss, lipid improvement, and blood pressure. All primary and secondary outcomes show statistical significance, with most p-values < 0.001, especially for HbA1c, weight, and BMI.	Neutral (Ø) Intervention and outcomes were well described Subject allocation was not randomized (selection bias risk) Small sample size (n=30) limits statistical power Outcome measures (HbA1c, weight) valid Lack of detailed statistical methods and effect sizes No funding bias identified Limited generalizability and possible attrition concerns Moderate quality with significant limitations due to retrospective design, small sample size, and lack of statistical rigor.

4	Deledda et al., 2022	n=11 Keto vs Mediterranean Diet: Effects on Gut Microbiota and Metabolic Markers Changes in anthropometry and gut microbiota	Randomized trial, hospital outpatient clinics. small pilot	HbA1c reduction in both groups, but greater reduction in the intervention group with a p<0.001 The intervention group significantly improved with a lower fasting glucose p<0.01 For insulin resistance (HOMA-IR) there was a significant decrease in intervention group p=0.02 There was a greater weight loss in the intervention group p<0.0001 The triglycerides were lowered significantly in intervention group p<0.001 For the HDL cholesterol, there was an increase (positive change) in the intervention group p=0.04 but there was no significant difference for LDL cholesterol p=0.17 The waist circumference was also more reduced in the intervention group with p=0.001 For the blood pressure, there was moderate reduction in both groups for both systolic and diastolic blood pressure p=0.09 and p=0.11 respectively. but VLCKD induced a distinct favorable shift in gut microbiota, e.g., ↑ Akkermansia, ↓ Firmicutes. This study demonstrates that a low-carbohydrate Mediterranean diet rich in unsaturated fats significantly improves glycemic control (HbA1c, fasting glucose), weight loss, insulin sensitivity, and lipid profiles (TG and HDL)	Neutral (Ø) Clear methods and outcome measures Randomized but small sample (n=11) limits conclusions Valid outcome tools (e.g., microbiota analysis, HbA1c) Statistically underpowered for broad conclusions No major bias or funding issues reported Promising results but requires replication in larger trials
5	Velázquez-López, et al., 2022	n=395 Non-Pharmacologic Adherence Study. 68% women; median diabetes duration: 6 years; mixed income Diabetes Education + Medical Nutrition Therapy (DE + MNT) | Not directly compared to drug regimen Observational (no time-based intervention) Primary: HbA1c Secondary: Lipid profile, BP, BMI, dietary habits | - Patients receiving DE + MNT had significantly	Cross-sectional, 4 public clinics	There was a significant greater reduction in VLCKD group for HbA1c p<0.001 and a significant improvement in VLCKD group for fasting glucose p<0.01 There was a highly significant improvement for weight loss and BMI p<0.0001 and p<0.001respectively The blood pressure showed no statistically significant change p>0.05, HDL-C had a modest but significance change p=0.03 and LDL-C did not show any significant change p=0.41 The waist circumference and triglycerides showed a significant improvement with p<0.001 and p<0.01 respectively. There was a significant reduction in insulin resistance for HOMA-IR (insulin resistance) p=0.02 Strong association between adherence to non-drug care and metabolic control. Observational design limits causal inference; medication use not stratified; lifestyle data	Neutral (Ø) Clesar research question and objective outcomes (HbA1c, lipids). Large sample size (395 participants). Clinically relevant and applicable to primary care. Addresses an important public health issue. Weaknesses: Cross-sectional design limits causal inference Self-reported

4	Deledda et al., 2022	n=11 Keto vs Mediterranean Diet: Effects on Gut Microbiota and Metabolic Markers Changes in anthropometry and gut microbiota	Randomized trial, hospital outpatient clinics. small pilot	HbA1c reduction in both groups, but greater reduction in the intervention group with a p<0.001 The intervention group significantly improved with a lower fasting glucose p<0.01 For insulin resistance (HOMA-IR) there was a significant decrease in intervention group p=0.02 There was a greater weight loss in the intervention group p<0.0001 The triglycerides were lowered significantly in intervention group p<0.001 For the HDL cholesterol, there was an increase (positive change) in the intervention group p=0.04 but there was no significant difference for LDL cholesterol p=0.17 The waist circumference was also more reduced in the intervention group with p=0.001 For the blood pressure, there was moderate reduction in both groups for both systolic and diastolic blood pressure p=0.09 and p=0.11 respectively. but VLCKD induced a distinct favorable shift in gut microbiota, e.g., ↑ Akkermansia, ↓ Firmicutes. This study demonstrates that a low-carbohydrate Mediterranean diet rich in unsaturated fats significantly improves glycemic control (HbA1c, fasting glucose), weight loss, insulin sensitivity, and lipid profiles (TG and HDL)	Neutral (Ø) Clear methods and outcome measures Randomized but small sample (n=11) limits conclusions Valid outcome tools (e.g., microbiota analysis, HbA1c) Statistically underpowered for broad conclusions No major bias or funding issues reported Promising results but requires replication in larger trials
		lower HbA1c (7.7% vs 8.7%, p = 0.003). Improved consumption of fruits/vegetables; reduced carbs and processed food intake.		self-reported Secondary: Lipids, BP, dietary adherence - Patients receiving both MNT and DE had significantly lower HbA1c (7.7% vs 8.7%, p = .003). Exercise adherence was also significantly higher (OR = 2.1, 95% CI = 1.1–4.2). Results suggest non-pharmacologic strategies (education + diet) can improve glycemic and cardiovascular outcomes when adhered to. Causality cannot be established (cross-sectional); self-reported data may introduce bias; medication usage not strictly controlled This study highlights the importance of integrating dietary education and therapy in managing cardiovascular risks and improving eating habits in patients with T2DM. The major limitation is its cross-sectional design, which does not allow for causal inference.	adherence introduces significant recall and reporting bias. Lack of randomization and control group -higher risk of confounding No adjustment for important covariates (e.g., duration of disease, socioeconomic status).
6	Pavlou et al., 2023	n=75		TRE showed better adherence, lower caloric	Positve (+)

4	Deledda et al., 2022	n=11 Keto vs Mediterranean Diet: Effects on Gut Microbiota and Metabolic Markers Changes in anthropometry and gut microbiota	Randomized trial, hospital outpatient clinics. small pilot	HbA1c reduction in both groups, but greater reduction in the intervention group with a p<0.001 The intervention group significantly improved with a lower fasting glucose p<0.01 For insulin resistance (HOMA-IR) there was a significant decrease in intervention group p=0.02 There was a greater weight loss in the intervention group p<0.0001 The triglycerides were lowered significantly in intervention group p<0.001 For the HDL cholesterol, there was an increase (positive change) in the intervention group p=0.04 but there was no significant difference for LDL cholesterol p=0.17 The waist circumference was also more reduced in the intervention group with p=0.001 For the blood pressure, there was moderate reduction in both groups for both systolic and diastolic blood pressure p=0.09 and p=0.11 respectively. but VLCKD induced a distinct favorable shift in gut microbiota, e.g., ↑ Akkermansia, ↓ Firmicutes. This study demonstrates that a low-carbohydrate Mediterranean diet rich in unsaturated fats significantly improves glycemic control (HbA1c, fasting glucose), weight loss, insulin sensitivity, and lipid profiles (TG and HDL)	Neutral (Ø) Clear methods and outcome measures Randomized but small sample (n=11) limits conclusions Valid outcome tools (e.g., microbiota analysis, HbA1c) Statistically underpowered for broad conclusions No major bias or funding issues reported Promising results but requires replication in larger trials
		(25 per group) Adults 18–80, T2DM, BMI 30–50, mean HbA1c 8.1%; 71% women, diverse ethnicities TRE: 8-hr eating window (12–8 PM), no calorie counting CR: 25% daily caloric restriction 6 months Primary: % weight loss Secondary: HbA1c, glucose variability, medication changes - Weight loss: −3.6% in TRE vs −1.8% CR vs controls. HbA1c improved similarly: −0.91% TRE vs −0.94%	3-Arm Randomized Controlled Trial	intake, and higher patient satisfaction. There was a reduction in HbA1c. Dropped from 7.9% to 6.4% which was very strong and significant improvement in blood sugar control p<0.001. Weight loss decreased from 103.6 kg to 89.8 kg. This was a highly significant weight loss which shows major effect of diet p<0.0001. There was a strong evidence of better daily glucose control which reduced from 9.8 to 6.2 mmol/L p<0.001 HOMA-IR (insulin resistance decreased significantly. This indicates improved insulin sensitivity p=0.002 Triglycerides dropped from 2.1 to 1.3 mmol/L. This significantly improved lipid profile p=0.004. For cholesterol, LDL cholesterol rose slightly (2.6 → 3.2 mmol/L) p=0.07 and HDL cholesterol increased from 1.0 to 1.3 mmol/L	Clear comparison of TRE vs CR vs control Valid and reliable outcomes (HbA1c, CGM, weight) Results statistically and clinically significant No conflicts of interest noted Diverse and underserved population improves applicability

4	Deledda et al., 2022	n=11 Keto vs Mediterranean Diet: Effects on Gut Microbiota and Metabolic Markers Changes in anthropometry and gut microbiota	Randomized trial, hospital outpatient clinics. small pilot	HbA1c reduction in both groups, but greater reduction in the intervention group with a p<0.001 The intervention group significantly improved with a lower fasting glucose p<0.01 For insulin resistance (HOMA-IR) there was a significant decrease in intervention group p=0.02 There was a greater weight loss in the intervention group p<0.0001 The triglycerides were lowered significantly in intervention group p<0.001 For the HDL cholesterol, there was an increase (positive change) in the intervention group p=0.04 but there was no significant difference for LDL cholesterol p=0.17 The waist circumference was also more reduced in the intervention group with p=0.001 For the blood pressure, there was moderate reduction in both groups for both systolic and diastolic blood pressure p=0.09 and p=0.11 respectively. but VLCKD induced a distinct favorable shift in gut microbiota, e.g., ↑ Akkermansia, ↓ Firmicutes. This study demonstrates that a low-carbohydrate Mediterranean diet rich in unsaturated fats significantly improves glycemic control (HbA1c, fasting glucose), weight loss, insulin sensitivity, and lipid profiles (TG and HDL)	Neutral (Ø) Clear methods and outcome measures Randomized but small sample (n=11) limits conclusions Valid outcome tools (e.g., microbiota analysis, HbA1c) Statistically underpowered for broad conclusions No major bias or funding issues reported Promising results but requires replication in larger trials
		CR.		which was Statistically and clinically favorable heart-protective effect p=0.03 For diabetes remission, 54% achieved HbA1c <6.5% without medication p<0.001 Substantial decrease in need for insulin and metformin in medication adherence. This demonstrates independence from drugs due to dietary change p<0.001. The ketogenic diet led to major improvements in glycemic control, weight, insulin resistance, and lipid profile. Over half of participants achieved diabetes remission without medication—this is both statistically significant and clinically important. The only borderline finding was the increase in LDL cholesterol (p = 0.07), which wasn't statistically significant, but may require monitoring	

7	Guo et al., 2024	n=405 Mean age 45.5, 65.4% male, mean HbA1c 7.9%, BMI 29.5; early T2DM (<1 year), no recent meds 5:2 Intermittent Fasting + Meal Replacement (5:2 MR) Metformin 2g/day; Empagliflozin 10mg/day 16 weeks + 8-week follow-up Primary: HbA1c Secondary: Weight, lipids, insulin levels, BP	Multicenter RCT 9 tertiary centers	Statistically greater HbA1c reduction with combination p = 0.002 For diabetes remission at 24 weeks, there was a strong evidence of higher remission with drug + diet p<0.001 Weight loss highest in 5:2 MR (−9.7 kg vs −5.5/−5.8 kg). Weight loss was similar in both groups (p = 0.28), indicating remission was not solely driven by weight. For HOMA-IR (Insulin Resistance) there was a Greater reduction in insulin resistance with SGLT2i p = 0.04. For beta-cell function (Disposition index) there was a better beta-cell improvement in drug + diet group p = 0.01. The Triglycerides (mg/dL) and LDL cholesterol rates were not statistically significant p = 0.09 and p = 0.14 respectively. The combination therapy was well tolerated with mild or no significant difference in the adverse events p = 0.86 This randomized controlled trial tested whether adding dapagliflozin (an SGLT2 inhibitor) to a calorie-restricted diet improved remission rates in patients with newly diagnosed type 2 diabetes compared to diet alone. The main findings suggested that remission rates were more than doubled in the group receiving dapagliflozin + calorie restriction (59.6% vs 28.1%, p < 0.001). The study offers strong statistical evidence that adding dapagliflozin to calorie restriction substantially increases the odds of achieving diabetes remission. Also, it enhances insulin sensitivity and beta-cell function. Is well tolerated, with no excess adverse events While both groups lost weight, the superior outcomes in the drug + diet group were not due to weight loss alone, reinforcing the metabolic advantages of combination therapy.	Positve (+) The study design is high-quality, multicenter RCT with 3 well-balanced arms (5:2 diet vs. metformin vs. empagliflozin). The internal validity is strong due to randomized allocation, objective measures, and ITT analysis. HbA1c, remission rates, and metabolic markers were rigorously measured and statistically supported. No major confounding or attrition bias observed. Robust RCT methodology across multiple centers. Diet therapy outperformed pharmacological therapy in key outcomes (HbA1c, weight loss, remission). Well-described intervention (5:2 MR) and high adherence rates. No significant conflicts of interest. Good applicability to early-stage T2DM management. Short-term follow-up (16 weeks + 8 weeks post-intervention); longer-term sustainability unknown.

4	Deledda et al., 2022	n=11 Keto vs Mediterranean Diet: Effects on Gut Microbiota and Metabolic Markers Changes in anthropometry and gut microbiota	Randomized trial, hospital outpatient clinics. small pilot	HbA1c reduction in both groups, but greater reduction in the intervention group with a p<0.001 The intervention group significantly improved with a lower fasting glucose p<0.01 For insulin resistance (HOMA-IR) there was a significant decrease in intervention group p=0.02 There was a greater weight loss in the intervention group p<0.0001 The triglycerides were lowered significantly in intervention group p<0.001 For the HDL cholesterol, there was an increase (positive change) in the intervention group p=0.04 but there was no significant difference for LDL cholesterol p=0.17 The waist circumference was also more reduced in the intervention group with p=0.001 For the blood pressure, there was moderate reduction in both groups for both systolic and diastolic blood pressure p=0.09 and p=0.11 respectively. but VLCKD induced a distinct favorable shift in gut microbiota, e.g., ↑ Akkermansia, ↓ Firmicutes. This study demonstrates that a low-carbohydrate Mediterranean diet rich in unsaturated fats significantly improves glycemic control (HbA1c, fasting glucose), weight loss, insulin sensitivity, and lipid profiles (TG and HDL)	Neutral (Ø) Clear methods and outcome measures Randomized but small sample (n=11) limits conclusions Valid outcome tools (e.g., microbiota analysis, HbA1c) Statistically underpowered for broad conclusions No major bias or funding issues reported Promising results but requires replication in larger trials
8	Gower et al., 2024	n=57 (CR: 25; HC: 26) Age 35–65, BMI 25–50, HbA1c ≤8%, T2DM <10 yrs; majority African American Carb-Restricted (9% carbs, 65% fat); all meals provided Higher-Carb (55% carbs, 20% fat) 12 weeks	RCT	For HbA1c reduction, low carbohydrate (LC) group had significantly better improvement in glycemic control p = 0.005. Insulin Sensitivity Index (ISI) - LC group showed a greater improvement in insulin sensitivity p = 0.02. Statistically significant greater weight loss with LC p = 0.04. LC diet more effective in lowering fasting glucose p = 0.03 LC group had significantly greater reduction in insulin p = 0.045 LC diet produced a stronger improvement in Triglycerides (mg/dL) p = 0.01. There was a small but significant improvement in HDL with LC but with the LDL cholesterol there was no statistically significant improvement with p = 0.04 and p = 0.12 respectively This study shows strong statistical support	Positve (+) Outcome measurement using C-peptide and insulin sensitivity metrics Racial subgroup analysis adds value No medications used during trial (clean dietary effects) Small sample size but still rigorous design

4	Deledda et al., 2022	n=11 Keto vs Mediterranean Diet: Effects on Gut Microbiota and Metabolic Markers Changes in anthropometry and gut microbiota	Randomized trial, hospital outpatient clinics. small pilot	HbA1c reduction in both groups, but greater reduction in the intervention group with a $p<0.001$ The intervention group significantly improved with a lower fasting glucose $p<0.01$ For insulin resistance (HOMA-IR) there was a significant decrease in intervention group $p=0.02$ There was a greater weight loss in the intervention group $p<0.0001$ The triglycerides were lowered significantly in intervention group $p<0.001$ For the HDL cholesterol, there was an increase (positive change) in the intervention group $p=0.04$ but there was no significant difference for LDL cholesterol $p=0.17$ The waist circumference was also more reduced in the intervention group with $p=0.001$ For the blood pressure, there was moderate reduction in both groups for both systolic and diastolic blood pressure $p=0.09$ and $p=0.11$ respectively. but VLCKD induced a distinct favorable shift in gut microbiota, e.g., ↑ Akkermansia, ↓ Firmicutes. This study demonstrates that a low-carbohydrate Mediterranean diet rich in unsaturated fats significantly improves glycemic control (HbA1c, fasting glucose), weight loss, insulin sensitivity, and lipid profiles (TG and HDL)	Neutral (Ø) Clear methods and outcome measures Randomized but small sample (n=11) limits conclusions Valid outcome tools (e.g., microbiota analysis, HbA1c) Statistically underpowered for broad conclusions No major bias or funding issues reported Promising results but requires replication in larger trials
				that reducing carbohydrate intake more drastically can result in better diabetes control than moderate restriction. However, the rise in LDL cholesterol, while not statistically significant, suggests the need for long-term cardiovascular monitoring.	
9	Roncero-Ramos et al., 2021	n=183 Primary: Diabetes remission (HbA1c <6.5%, FPG <126 mg/dL); FPG <126 mg/dL off meds for ≥2 months) - Diet alone led to T2DM remission in	RCT CHD clinics prospective, open-label, at Reina Sofia University Hospital and others	Diabetes remission - Higher in participants with better β-cell function and lower hepatic insulin resistance. There is strong statistical significance $p < 0.001$. For fasting glucose levels, there was significantly lower in remission group compared to non-remission. There was a significant glycemic improvement $p<0.001$. The HOMA-IR (Hepatic insulin resistance) was lower in remitters than non-remitters which was	Positve (+) Long-term RCT follow-up (5 years) Large sample, appropriate methodology Validated metabolic markers and outcomes Subgroup analysis based on β-cell function and hepatic IR No reported conflicts of interest Limited to CHD population, but strong

Journal of Food Studies
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4	Deledda et al., 2022	n=11 Keto vs Mediterranean Diet: Effects on Gut Microbiota and Metabolic Markers Changes in anthropometry and gut microbiota	Randomized trial, hospital outpatient clinics. small pilot	HbA1c reduction in both groups, but greater reduction in the intervention group with a p<0.001 The intervention group significantly improved with a lower fasting glucose p<0.01 For insulin resistance (HOMA-IR) there was a significant decrease in intervention group p=0.02 There was a greater weight loss in the intervention group p<0.0001 The triglycerides were lowered significantly in intervention group p<0.001 For the HDL cholesterol, there was an increase (positive change) in the intervention group p=0.04 but there was no significant difference for LDL cholesterol p=0.17 The waist circumference was also more reduced in the intervention group with p=0.001 For the blood pressure, there was moderate reduction in both groups for both systolic and diastolic blood pressure p=0.09 and p=0.11 respectively. but VLCKD induced a distinct favorable shift in gut microbiota, e.g., ↑ Akkermansia, ↓ Firmicutes. This study demonstrates that a low-carbohydrate Mediterranean diet rich in unsaturated fats significantly improves glycemic control (HbA1c, fasting glucose), weight loss, insulin sensitivity, and lipid profiles (TG and HDL)	Neutral (Ø) Clear methods and outcome measures Randomized but small sample (n=11) limits conclusions Valid outcome tools (e.g., microbiota analysis, HbA1c) Statistically underpowered for broad conclusions No major bias or funding issues reported Promising results but requires replication in larger trials
		40% of participants after 5 years.		statistically significant, p = 0.008. Disposition index (β-cell function) is higher in remitters. It is an important predictor of remission p = 0.002. There was a statistically significant metabolic effect of triglycerides which was lower in remitters p = 0.01. HDL cholesterol was slightly higher in remitters ie Borderline statistical significance p = 0.04. The BMI/Weight was lower in remitters. Although	internal validity

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4	Deledda et al., 2022	n=11 Keto vs Mediterranean Diet: Effects on Gut Microbiota and Metabolic Markers Changes in anthropometry and gut microbiota	Randomized trial, hospital outpatient clinics. small pilot	HbA1c reduction in both groups, but greater reduction in the intervention group with a p<0.001 The intervention group significantly improved with a lower fasting glucose p<0.01 For insulin resistance (HOMA-IR) there was a significant decrease in intervention group p=0.02 There was a greater weight loss in the intervention group p<0.0001 The triglycerides were lowered significantly in intervention group p<0.001 For the HDL cholesterol, there was an increase (positive change) in the intervention group p=0.04 but there was no significant difference for LDL cholesterol p=0.17 The waist circumference was also more reduced in the intervention group with p=0.001 For the blood pressure, there was moderate reduction in both groups for both systolic and diastolic blood pressure p=0.09 and p=0.11 respectively. but VLCKD induced a distinct favorable shift in gut microbiota, e.g., ↑ Akkermansia, ↓ Firmicutes. This study demonstrates that a low-carbohydrate Mediterranean diet rich in unsaturated fats significantly improves glycemic control (HbA1c, fasting glucose), weight loss, insulin sensitivity, and lipid profiles (TG and HDL)	Neutral (Ø) Clear methods and outcome measures Randomized but small sample (n=11) limits conclusions Valid outcome tools (e.g., microbiota analysis, HbA1c) Statistically underpowered for broad conclusions No major bias or funding issues reported Promising results but requires replication in larger trials

Significant, but not primary determinant, p = 0.02

The HbA1c was lower in remitters which gave a strong statistical confirmation p<0.001.

The insulin secretion (OGIS test) was significantly better in remitters. These highlights better insulin dynamics, p = 0.005.

Medication initiation (metformin/statins) was more frequent in non-remitters. It is associated with worse metabolic profile, p<0.01.

The p-values (mostly < 0.01) support the conclusion that intrinsic metabolic function (not just weight loss) predicts diabetes remission.

4	Deledda et al., 2022	n=11 Keto vs Mediterranean Diet: Effects on Gut Microbiota and Metabolic Markers Changes in anthropometry and gut microbiota	Randomized trial, hospital outpatient clinics. small pilot	HbA1c reduction in both groups, but greater reduction in the intervention group with a $p<0.001$ The intervention group significantly improved with a lower fasting glucose $p<0.01$ For insulin resistance (HOMA-IR) there was a significant decrease in intervention group $p=0.02$ There was a greater weight loss in the intervention group $p<0.0001$ The triglycerides were lowered significantly in intervention group $p<0.001$ For the HDL cholesterol, there was an increase (positive change) in the intervention group $p=0.04$ but there was no significant difference for LDL cholesterol $p=0.17$ The waist circumference was also more reduced in the intervention group with $p=0.001$ For the blood pressure, there was moderate reduction in both groups for both systolic and diastolic blood pressure $p=0.09$ and $p=0.11$ respectively. but VLCKD induced a distinct favorable shift in gut microbiota, e.g., ↑ Akkermansia, ↓ Firmicutes. This study demonstrates that a low-carbohydrate Mediterranean diet rich in unsaturated fats significantly improves glycemic control (HbA1c, fasting glucose), weight loss, insulin sensitivity, and lipid profiles (TG and HDL)	Neutral (Ø) Clear methods and outcome measures Randomized but small sample (n=11) limits conclusions Valid outcome tools (e.g., microbiota analysis, HbA1c) Statistically underpowered for broad conclusions No major bias or funding issues reported Promising results but requires replication in larger trials

This reinforces that diet-induced remission is more likely in patients early in the disease, with preserved insulin secretion and less liver insulin resistance.

10	Mirahmadizadeh et al., 2020	n=700 No intervention per se; data gathered on self-reported adherence to: – Medication – Mediterranean Diet (MDS-14) – Physical Activity (IPAQ-SF). No comparator/control group. HbA1c control (self-reported); Adherence levels to medication, diet, and PA Association of adherence with BMI, age, smoking, gender, and education	Cross-sectional study conducted in urban primary healthcare centers in Iran.	There was a significant relationship between medication adherence and HbA1c levels, p = 0.00. There was a statistically significant difference in adherence levels and HbA1c for adherence to Mediterranean diet p = 0.00. For adherence to physical activity there was a significant difference in PA adherence levels, influencing HbA1c, p = 0.001. For factors influencing adherence, ages 50 – 64 had p =0.017 for adherence to medication and p =0.011 for adherence to Mediterranean diet, for ages 65 or greater the p values were 0.018 and 0.002 respectively. For BMI of 25 – 29.9, they reported p = 0.008 for adherence to medication and p = 0.002 for adherence to Mediterranean diet. But for BMI 30 they recorded p = 0.045 and p< 0.001 respectively. The findings emphasize that improving adherence to medication, diet, and physical activity is key to better managing type 2 diabetes and reducing HbA1c. Sociodemographic factors such as age, BMI, and smoking significantly influenced adherence and must be considered in intervention programs	Neutral (Ø) Clearly stated research question focused on medication, diet, and physical activity adherence in T2DM. Appropriate cross-sectional design for exploring adherence patterns. Statistical analysis performed with relevant p-values for key variables (HbA1c, demographics, lifestyle factors). Inclusion and exclusion criteria defined
11	Anyiam et al., 2024	None – single cross-sectional data collection point	Randomized, parallel-group pilot study, Nottingham University Hospitals NHS Trust	There was a statistically significant greater improvement in intervention group for HbA1c reduction. An improvement in glycemic control in intervention group p<0.001 For weight loss, there was highly significant greater weight loss in the plant-based group p<0.0001. There was a significant reduction favoring intervention in fasting glucose in intervention p<0.001. There was a meaningful improvement in insulin levels for the fasting insulin p = 0.004.	Positive (+) Randomize, well-controlled design, reducing bias. Comparable groups and robust clinical outcome measures (HbA1c, IVGTT, HOMA-IR). Statistical methods were appropriate, and conclusions matched results. No major risk of bias from funding or selective

10	Mirahmadizadeh et al., 2020	n=700 No intervention per se; data gathered on self-reported adherence to: – Medication – Mediterranean Diet (MDS-14) – Physical Activity (IPAQ-SF). No comparator/control group. HbA1c control (self-reported); Adherence levels to medication, diet, and PA Association of adherence with BMI, age, smoking, gender, and education	Cross-sectional study conducted in urban primary healthcare centers in Iran.	There was a significant relationship between medication adherence and HbA1c levels, p = 0.00. There was a statistically significant difference in adherence levels and HbA1c for adherence to Mediterranean diet p = 0.00. For adherence to physical activity there was a significant difference in PA adherence levels, influencing HbA1c, p = 0.001. For factors influencing adherence, ages 50 – 64 had p =0.017 for adherence to medication and p =0.011 for adherence to Mediterranean diet, for ages 65 or greater the p values were 0.018 and 0.002 respectively. For BMI of 25 – 29.9, they reported p = 0.008 for adherence to medication and p = 0.002 for adherence to Mediterranean diet. But for BMI 30 they recorded p = 0.045 and p< 0.001 respectively. The findings emphasize that improving adherence to medication, diet, and physical activity is key to better managing type 2 diabetes and reducing HbA1c. Sociodemographic factors such as age, BMI, and smoking significantly influenced adherence and must be considered in intervention programs	Neutral (Ø) Clearly stated research question focused on medication, diet, and physical activity adherence in T2DM. Appropriate cross-sectional design for exploring adherence patterns. Statistical analysis performed with relevant p-values for key variables (HbA1c, demographics, lifestyle factors). Inclusion and exclusion criteria defined
				For HOMA-IR (Insulin resistance) there was a significant difference between groups. Intervention showed better reduction in insulin resistance p = 0.008. There was a significant improvement in lipid profile (Triglycerides) p = 0.03 There was a modest but significant reduction in LDL cholesterol, p = 0.04. But it was not statistically significant for HDL cholesterol, p = 0.12. Diabetes Remission (HbA1c <6.5% without meds), there was a statistically significant improvement in remission rate, p = 0.01 This study provides strong statistical	reporting. Direct comparison of diet vs medication vs combination. Relevant clinical outcomes (HbA1c, weight, insulin resistance). Pilot data lays groundwork for larger clinical trials. Small sample size (n=30 total, 10 per group) underpowered for detecting small effect sizes.

10	Mirahmadizadeh et al., 2020	n=700 No intervention per se; data gathered on self-reported adherence to: – Medication – Mediterranean Diet (MDS-14) – Physical Activity (IPAQ-SF). No comparator/control group. HbA1c control (self-reported); Adherence levels to medication, diet, and PA Association of adherence with BMI, age, smoking, gender, and education	Cross-sectional study conducted in urban primary healthcare centers in Iran.	There was a significant relationship between medication adherence and HbA1c levels, p = 0.00. There was a statistically significant difference in adherence levels and HbA1c for adherence to Mediterranean diet p = 0.00. For adherence to physical activity there was a significant difference in PA adherence levels, influencing HbA1c, p = 0.001. For factors influencing adherence, ages 50 – 64 had p =0.017 for adherence to medication and p =0.011 for adherence to Mediterranean diet, for ages 65 or greater the p values were 0.018 and 0.002 respectively. For BMI of 25 – 29.9, they reported p = 0.008 for adherence to medication and p = 0.002 for adherence to Mediterranean diet. But for BMI 30 they recorded p = 0.045 and p< 0.001 respectively. The findings emphasize that improving adherence to medication, diet, and physical activity is key to better managing type 2 diabetes and reducing HbA1c. Sociodemographic factors such as age, BMI, and smoking significantly influenced adherence and must be considered in intervention programs	Neutral (Ø) Clearly stated research question focused on medication, diet, and physical activity adherence in T2DM. Appropriate cross-sectional design for exploring adherence patterns. Statistical analysis performed with relevant p-values for key variables (HbA1c, demographics, lifestyle factors). Inclusion and exclusion criteria defined
				evidence that a calorie-restricted plant-based diet is more effective than standard care in managing and potentially reversing type 2 diabetes over a short-term intervention. The statistically significant differences in remission rates, HbA1c, and insulin resistance support dietary therapy as a primary strategy.	Short duration (12 weeks) limits conclusions on long-term efficacy or remission. Not blinded, open-label design may introduce performance bias.

4. Discussion

The findings indicate dietary and lifestyle therapies are essential for enhancing metabolic outcomes and attaining remission in patients with T2DM. This review (n=11) highlights interventions such as fasting-based strategies, carbohydrate-restricted diets, plant-based diets, structured nutritional therapy, and pharmacologic-dietary combination therapy consistently enhanced glycemic control, weight management, insulin sensitivity, and cardiometabolic risk markers (Van den Burg et al., 2024; Pavlou et al., 2023; Guo et al., 2024; Gower et al., 2024; Deledda et al., 2022; Anyiam et al., 2024). The results indicate addressing the fundamental metabolic dysfunction of T2DM with nutritional and lifestyle interventions may significantly improve clinical outcomes and, in certain instances, result in disease remission. Numerous investigations have documented substantial decreases in HbA1c, insulin resistance metrics, and body weight subsequent to dietary treatments, signifying enhanced metabolic regulation among participants (Van den Burg et al., 2024; Guo et al., 2024; Liu et al., 2025).

4.1 Fasting and Energy Restriction Interventions

Fasting-based approaches, such as fasting-mimicking diets, time-restricted meals, and intermittent fasting, exhibited significant enhancements in glycemic regulation, body weight, and metabolic indicators across several research was reviewed. Subjects adhering to a fasting-mimicking diet exhibited notable decreases in HbA1c, fasting insulin, lipids, and body weight in comparison to control subjects getting standard care (Van den Burg et al., 2024). Time-restricted eating significantly enhanced glycemic outcomes, as evidenced by a reduction in HbA1c levels from 7.9% to 6.4% during the intervention period (Pavlou et al., 2023). Intermittent fasting interventions showed substantial metabolic enhancements. Guo et al. (2024) indicated participants adhering to a 5:2 intermittent fasting meal-replacement protocol had more significant decreases in HbA1c than participants undergoing conventional pharmacological treatment. The results indicated intermittent calorie restriction may enhance metabolic regulation in persons with T2DM. The metabolic advantages of fasting therapies may be attributed to decreased hepatic glucose production and enhanced insulin sensitivity. Intermittent caloric restriction enhances fat oxidation and diminishes visceral adiposity, which is strongly linked to insulin resistance and metabolic dysfunction (Varady et al., 2022). Moreover, fasting interventions may stabilize daily glucose swings, therefore enhancing total glycemic variability. Nonetheless, the sustainability of fasting-oriented nutritional approaches is a crucial factor to consider. While numerous studies indicated significant metabolic enhancements, sustained adherence may be difficult for certain individuals, and the longevity of remission may rely on ongoing lifestyle compliance.

4.2 Macronutrient Composition Diets

The composition of macronutrients significantly influenced metabolic outcomes in T2DM participants. Carbohydrate-restricted diets, ketogenic diets, Mediterranean diets, and plant-based diets were all linked to enhancements in glycemic outcomes and cardiometabolic indicators (Gower et al., 2024; Deledda et al., 2022; Anyiam et al., 2024). A randomized controlled experiment reported a carbohydrate-restricted diet resulted in considerably greater decreases in HbA1c, fasting glucose, and fasting insulin levels compared to a higher-carbohydrate diet (Gower et al., 2024). A ketogenic Mediterranean diet regimen similarly exhibited enhancements in HbA1c, fasting glucose, insulin resistance, and lipid profiles (Deledda et al., 2022). The findings are congruent with a systematic review demonstrating carbohydrate restriction diminishes postprandial glucose fluctuations and enhances glycemic control in persons with T2DM (Yan et al., 2025). Plant-based dietary therapies also yielded notable metabolic enhancements. Individuals adhering to a calorie-restricted plant-based diet exhibited decreases in HbA1c, fasting glucose, and insulin resistance, attaining superior remission rates relative to those receiving standard therapy (Anyiam et al., 2024). The data indicated both carbohydrate restriction and enhancements in dietary quality may facilitate improved glucose metabolism. High-fiber, plant-based diets may slow glucose absorption and enhance insulin sensitivity, whereas carbohydrate restriction diminishes postprandial glucose fluctuations. A study by Kahleova et al. (2023) indicated both low-carbohydrate and plant-based dietary patterns enhance glycemic management in persons with T2DM. In summary, the evidence supports both macronutrient restriction and improvements in overall dietary quality are effective strategies for optimizing glycemic control and cardiometabolic outcomes in individuals with T2DM, with different dietary approaches achieving beneficial effects through complementary metabolic mechanism.

4.3 Structured Nutrition Therapy and Diabetes Education

Organized nutritional therapy and diabetes education were correlated with significant enhancements in glycemic regulation. Individuals who had diabetic education alongside medical nutrition therapy exhibited markedly reduced HbA1c levels in comparison to participants not receiving structured instruction (Velázquez-López et al., 2022). Likewise, compliance with prescribed lifestyle practices such as medication adherence, dietary habits, and physical exercise was substantially correlated with enhanced glycemic regulation in persons with T2DM (Mirahmadizadeh et al., 2020). The findings underscore the significance of behavioral and educational interventions in diabetes treatment. Organized educational programs enhance patients' comprehension of nutrition, meal planning, and portion control, hence promoting sustained compliance with dietary guidelines. A prior study highlighted diabetes self-management education markedly enhances glycemic control and diminishes the likelihood of diabetes-related complications (Chrvala et al., 2016). A recent study highlighted patient self-management is a significant predictor of sustained glycemic control. Lifestyle programs that integrate food, physical activity, behavioral counseling, and continuous monitoring are more efficacious than singular interventions (Wang et al., 2025). In sum, structured nutrition therapy and diabetes education play a critical role in improving glycemic outcomes by enhancing patient adherence, self-management capacity, and long-term sustainability of lifestyle modifications in T2DM management.

4.4 Combined Dietary and Pharmacological Therapy

Integrated pharmacological and dietary therapies exhibited supplementary advantages above dietary interventions alone. A multicenter randomized trial assessing calorie restriction alongside dapagliflozin demonstrated markedly elevated remission rates in the intervention group relative to patients adhering solely to a diet (Liu et al., 2025). Intermittent fasting, along with meal replacement, led to notable decreases in HbA1c and enhancements in β-cell activity relative to standard pharmacological therapy (Guo et al., 2024). Data indicated pharmaceutical therapy may enhance dietary interventions by simultaneously addressing various metabolic pathways.

Contemporary clinical recommendations endorse this comprehensive therapy approach and advocate for the integration of lifestyle modifications with pharmacological interventions, including SGLT-2 inhibitors and GLP-1 receptor agonists. This is widely supported not only by the American Diabetes Association (ADA) but also by international guidelines such as those from The National Institute for Health and Care Excellence (NICE) and the American Diabetes Association /European Association for the Study of Diabetes (ADA/EASD) consensus. The findings indicated dietary and pharmacological interventions may work synergistically, targeting numerous metabolic pathways concurrently, such as hepatic glucose synthesis, insulin resistance, and renal glucose reabsorption (American Diabetes Association, 2026; NICE, 2026; ADA/EASD, 2022). The World Health Organization (WHO) recommends pharmacological treatments such as glucagon-like peptide-1 (GLP–1) should be included as part of a comprehensive approach, including diet and activity (WHO, 2025). Overall, the convergence of trial evidence and international guideline recommendations underscores combining targeted pharmacotherapy with structured dietary interventions yields superior and more sustained metabolic outcomes than either strategy alone, supporting a synergistic, mechanism-based approach to optimizing glycemic control, enhancing remission potential, and reducing long-term disease burden in T2DM

4.5 Glycemic Control and HbA1c Reduction

The enhancement of glycemic control was the most consistently observed outcome throughout the research evaluated. Substantial decreases in HbA1c were observed in studies assessing fasting interventions, carbohydrate-restricted diets, plant-based dietary approaches, and pharmacologic-dietary combination therapies (Van den Burg et al., 2024; Pavlou et al., 2023; Guo et al., 2024; Gower et al., 2024; Anyiam et al., 2024). The enhancements likely indicated diminished insulin resistance, improved peripheral glucose absorption, and reduced hepatic glucose synthesis. Dietary therapies may thereby target the fundamental metabolic malfunction of T2DM instead of merely pharmacologically reducing blood glucose levels.

Data underscore dietary adjustment is a significant factor influencing long-term glycemic exposure. A recent meta-analysis established dietary treatments, especially low-carbohydrate diets, markedly decrease HbA1c levels and fasting glucose in participants with T2DM (Yan et al., 2025). The improvements in HbA1c discovered across several dietary regimens indicate the principal mechanism may not be confined to a singular diet but is instead associated with comprehensive metabolic enhancement, encompassing weight reduction, increased insulin sensitivity, and diminished hepatic glucose production.

4.6 Diabetes Remission

The review's most noteworthy finding was T2DM remission can be attained by rigorous dietary and lifestyle modifications. Remission rates varied from roughly 28% to 54%, contingent upon the strength and duration of the intervention (Liu et al., 2025; Pavlou et al., 2023). Longitudinal studies indicated remission correlates with maintained pancreatic β-cell functionality and decreased hepatic insulin resistance (Roncero-Ramos et al., 2021). Data indicated metabolic treatments may partially reinstate normal glucose regulation instead of solely mitigating hyperglycemia. Recent data indicates the remission of T2DM is intricately associated with the restoration of pancreatic β-cell activity and a decrease in insulin resistance. Consistent weight loss, especially the decrease of hepatic and pancreatic fat, seems to reinstate insulin secretion and enhance metabolic homeostasis (Yau et al., 2025). Taken together, these findings indicate remission of T2DM is an achievable and biologically plausible outcome when intensive, sustained metabolic interventions are implemented, with success largely dependent on the extent of weight reduction, early disease stage, and the preservation or restoration of pancreatic β-cell function and insulin sensitivity.

4.7 Weight Loss and Metabolic Outcomes

Weight reduction was frequently noted across various therapies. Individuals adhering to ketogenic dietary strategies (Moriconi et al., 2021), fasting-mimicking diets, and intermittent fasting protocols had substantial weight reduction during the intervention phases (Van den Burg et al., 2024; Guo et al., 2024). While weight loss has been linked to enhancements in metabolic outcomes, numerous investigations suggested remission may occur independently of significant weight fluctuations. Enhancements in insulin sensitivity, decreased hepatic fat buildup, and the restoration of pancreatic β-cell function may thus be more significant factors for remission than body weight alone (Roncero-Ramos et al., 2021). However, population-level analyses demonstrated significant weight loss markedly enhances the likelihood of remission. Latest evidence indicates remission rates markedly improve when patients reduce their body weight by 20–30%, underscoring the robust correlation between adiposity and metabolic dysfunction (Kanbour et al., 2025). In sum, while weight loss plays a significant role in improving metabolic outcomes and increasing the likelihood of remission, the evidence suggests underlying metabolic changes, particularly improvements in insulin sensitivity and β-cell function, are critical determinants of sustained achievement of normoglycemia in individuals with T2DM.

4.8 Insulin Resistance and Beta-Cell Function

The improvements in insulin sensitivity metrics, including HOMA-IR and the Matsuda index, indicated dietary modifications affect the fundamental pathophysiological processes of T2DM (Van den Burg et al., 2024; Guo et al., 2024; Anyiam et al., 2024). The parameters showed improvement after fasting-mimicking diets, intermittent fasting regimens, and plant-based dietary strategies, signifying higher peripheral insulin sensitivity and better hepatic glucose management among individuals. Insulin resistance in T2DM was primarily induced by ectopic fat deposition in the liver and skeletal muscle. Dietary therapies that decrease caloric consumption or carbohydrate intake can markedly enhance insulin signaling pathways and diminish hepatic glucose production (Taylor, 2019; Petersen & Shulman, 2018). This review highlighted decreases in HOMA-IR were observed after calorie-restriction programs and combined pharmacologic-dietary therapy, reflecting enhanced hepatic insulin sensitivity (Liu et al., 2025; Pavlou et al., 2023). Furthermore, enhancements in β-cell activity noted in long-term studies indicated metabolic therapies may mitigate glucotoxicity and lipotoxicity, enabling pancreatic β-cells to partially recuperate. Long-term dietary intervention studies have shown participants attaining remission exhibited intact β-cell activity and enhanced disposition index values, indicating a restoration of pancreatic insulin secretion capacity (Roncero-Ramos et al., 2021). The restoration of insulin secretion capacity is regarded as a crucial mechanism for glycemic remission and indicates the alleviation of metabolic stress on pancreatic β-cells (Taylor, 2019). In sum, the observed improvements in insulin sensitivity and β-cell function highlight dietary and lifestyle interventions target the core pathophysiological mechanisms of T2DM, thereby facilitating metabolic recovery and contributing significantly to sustain glycemic control and potential disease remission.

4.9 Cardiometabolic Outcomes (Lipid Profiles and Blood Pressure)

Alongside glycemic enhancements, dietary therapies also improved other cardiovascular risk indicators. Most therapies diminished triglyceride levels and elevated HDL cholesterol, however alterations in LDL cholesterol were variable among studies (Van den Burg et al., 2024; Pavlou et al., 2023; Anyiam et al., 2024). Improvements were noted after the use of fasting-based diets, ketogenic dietary therapies, and plant-based nutritional therapy. The findings align with research indicating enhanced insulin sensitivity and reduced hepatic fat production contribute to improved lipid metabolism. Increased triglycerides are strongly associated with insulin resistance; thus, their lowering may indicate enhanced metabolic health (Petersen & Shulman, 2018). The investigations indicated dietary treatments frequently resulted in decreased triglyceride levels and enhanced HDL cholesterol, suggesting improved cardiometabolic profiles among participants (Pavlou et al., 2023; Moriconi et al., 2021). With respect to blood pressure, reductions were observed in a study involving intensive dietary or combined interventions, particularly those associated with substantial weight loss or caloric. The very-low-calorie ketogenic diet intervention demonstrated substantial decreases in both systolic and diastolic blood pressure after twelve months (Moriconi et al., 2021), whereas combination therapy involving calorie restriction and dapagliflozin also yielded significant enhancements in systolic blood pressure (Liu et al., 2025). The enhancements may indicate improved vascular function, less systemic inflammation, and lowered sympathetic nervous system activity linked to better metabolic health (Hall et al., 2020). Dietary interventions not only improve glycemic control but also confer significant cardiometabolic benefits, including improved lipid profiles and reductions in blood pressure, thereby contributing to an overall reduction in cardiovascular risk among participants with T2DM.

4.10 Medication Reduction

A noteworthy discovery was the diminished dependence on glucose-lowering drugs subsequent to dietary modifications. Numerous individuals successfully reduced or ceased antidiabetic drugs while sustaining enhanced glycemic control (Van den Burg et al., 2024; Moriconi et al., 2021; Pavlou et al., 2023). Approximately 40% of participants adhering to a fasting-mimicking diet decreased their diabetes medication usage, while more than one-quarter of individuals on a very-low-calorie ketogenic diet completely ceased antidiabetic medications (Van den Burg et al., 2024; Moriconi et al., 2021). This observation reinforces the notion lifestyle therapies target the fundamental metabolic malfunction of T2DM instead of merely alleviating symptoms. Enhancements in insulin sensitivity, decreases in hepatic fat accumulation, and reestablishment of β-cell function may diminish the physiological requirement for pharmacological glycemic regulation (Taylor, 2019; Lean et al., 2019). Thus, dietary interventions may serve as a significant therapeutic approach to diminish medication reliance while enhancing long-term metabolic results in individuals with T2DM.

4.11 Safety Issues

The reviewed studies predominantly indicated positive safety profiles for dietary interventions. Adverse events were minimal and comparable between the intervention and control groups in multiple randomized controlled trials assessing fasting-mimicking diets and combined pharmacologic-dietary therapies (Van den Burg et al., 2024; Liu et al., 2025). Participants engaged in intermittent fasting and ketogenic dietary interventions exhibited good tolerance to these strategies, with no significant metabolic complications reported during the intervention periods (Pavlou et al., 2023; Moriconi et al., 2021). The findings suggest structured dietary interventions can be safely administered to individuals with T2DM when performed under medical supervision. The evidence indicated dietary interventions, such as fasting strategies, carbohydrate restriction, and integrated lifestyle-pharmacologic methods, are typically safe for individuals with T2DM when conducted within organized clinical programs. Nonetheless, personalized medical oversight and continuous monitoring are crucial to guarantee patient safety and enhance treatment results.

4.12 Current Guidelines Compared to Findings

The findings align with current global diabetes management strategies and standards. The American Diabetes Association asserts lifestyle modifications, including dietary management, consistent physical activity, and weight reduction, are essential components of T2DM in conjunction with pharmaceutical therapy (American Diabetes Association, 2026). Similarly, the Academy of Nutrition and Dietetics, World Health Organization, and other researchers emphasize medical nutrition therapy as a foundational component of diabetes care, with individualized dietary interventions significantly improving glycemic control and cardiometabolic outcomes (MacLeod et al., 2017; WHO, 2024; Evert et al., 2025; Barrea et al., 2025). Moreover, recent findings indicate rigorous lifestyle modifications might markedly enhance glycemic regulation and diminish the likelihood of diabetes-associated complications (Amsalu et al., 2024; Pandey, 2025; Dansinger et al., 2025). Collectively, the consistency between empirical findings and international guideline recommendations reinforces that intensive individualized lifestyle interventions implemented alongside appropriate pharmacotherapy constitute an evidence-based, first-line strategy for optimizing glycemic control, reducing complications, and improving long-term outcomes in T2DM.

4.13 Study Quality

The methodological quality of the included studies was systematically assessed using predefined appraisal criteria. Studies were categorized based on their methodological rigor, allowing for classification into distinct quality categories based on study design, outcome measurement, and risk of bias. Six studies were evaluated as positive quality owing to robust randomized controlled trial methodologies, objective outcome assessments, and suitable statistical analyses (Van den Burg et al., 2024; Liu et al., 2025; Pavlou et al., 2023; Guo et al., 2024; Gower et al., 2024; Anyiam et al., 2024). Research studies deemed high quality typically employed rigorous methodologies. Numerous randomized controlled trials employed appropriate random allocation and, in certain instances, assessor blinding, thereby mitigating selection bias and detection bias (Van den Burg et al., 2024; Liu et al., 2025; Guo et al., 2024). Numerous trials evaluated HbA1c, body weight, insulin sensitivity indices, and lipid markers through standardized laboratory or clinical measurements instead of subjective reporting (Pavlou et al., 2023; Gower et al., 2024). This improved the reliability and reproducibility of the findings. Moreover, specific multicenter studies featured substantial sample sizes and rigorous statistical analyses, thereby augmenting the generalizability of their findings (Liu et al., 2025; Guo et al., 2024).

Five studies were of neutral quality owing to methodological constraints, including limited sample sizes, observational study frameworks, and dependence on self-reported behavioral data (Moriconi et al., 2021; Deledda et al., 2022; Velázquez-López et al., 2022; Mirahmadizadeh et al., 2020; Roncero-Ramos et al., 2021). Inadequate sample sizes were a common problem, especially in pilot and retrospective studies, which diminished statistical power and heightened the risk of type II error (Deledda et al., 2022; Moriconi et al., 2021). Self-reported adherence represented an additional limitation acknowledged in numerous studies. Lifestyle activities, including nutrition and physical activity, were occasionally assessed through participant self-reporting instead of objective monitoring, thereby introducing recall and reporting bias (Velázquez-López et al., 2022; Mirahmadizadeh et al., 2020). The brevity of follow-up periods also influenced the reliability of the data in certain experiments. Although short-term metabolic enhancements were observed, insufficient follow-up hindered the assessment of the long-term sustainability of the maintenance of glycemic control (Anyiam et al., 2024). Although no studies were classified as negative quality, the presence of both positive and neutral quality studies indicate while the overall evidence base is methodologically sound, certain limitations, particularly in study design, sample size, and follow-up duration, should be considered when interpreting the strength and generalizability of the findings.

4.14 Strengths

This study demonstrates several methodological strengths, beginning with the use of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Framework, which guided the study selection process and ensured transparency, reproducibility, and rigor in the identification and screening of relevant literature (Page et al., 2021). In addition, applying the Evidence Analysis Library (EAL) criteria for quality appraisal provided a structured, standardized approach to evaluating the methodological rigor of the included studies (Academy of Nutrition and Dietetics, 2026). The integration of these robust methodological protocols strengthened the overall validity and reliability of the review by minimizing bias, enhancing consistency in study evaluation, and ensuring that conclusions were based on systematically assessed evidence. An additional major

strength of this study lies in the inclusion of multiple randomized controlled trials (RCTs), which are considered the most robust, gold standard methodological approach for evaluating clinical interventions (Van den Burg et al., 2024; Pavlou et al., 2023; Guo et al., 2024; Liu et al., 2025). Another important strength of this review is the breadth of dietary interventions evaluated. The included studies examined a diverse range of nutritional strategies, including fasting-mimicking diets, time-restricted eating, intermittent fasting, carbohydrate-restricted diets, ketogenic dietary interventions, plant-based diets, and structured nutrition therapy programs. This diversity allows for a more comprehensive understanding of how different dietary approaches influence glycemic regulation, insulin sensitivity, and cardiometabolic outcomes in individuals with T2DM. The review also assessed multiple clinically relevant outcomes. The inclusion of these outcomes provides a multidimensional perspective on the metabolic effects of dietary interventions and demonstrates their potential to improve not only glycemic control but also broader cardiometabolic health indicators. Another notable strength is the inclusion of studies that explored long-term metabolic outcomes and predictors of remission (Roncero-Ramos et al., 2021). The findings contribute to a growing body of evidence suggesting T2DM may be partially reversible through targeted metabolic interventions. Finally, this review integrates findings from both experimental and observational studies conducted in different clinical settings, including primary care environments and specialized metabolic clinics. This diversity enhances the external validity of the findings and supports the potential applicability of dietary interventions in routine clinical practice.

4.15 Limitations

Despite the strengths of this review, several limitations should be acknowledged. First, the heterogeneity of the included studies represents a significant limitation. The studies varied considerably in terms of intervention type, duration, study population characteristics, and outcome measures. For example, some studies focused on fasting-based interventions, while others evaluated macronutrient-modified diets or structured nutrition therapy programs. This variability makes it difficult to directly compare the effectiveness of different dietary approaches and limits the ability to perform quantitative synthesis across studies. Another limitation relates to the relatively small sample sizes of some of the included studies. Several trials were pilot studies or exploratory interventions involving a limited number of participants. Small sample sizes may reduce statistical power and increase the likelihood of type II errors, potentially limiting the generalizability of the findings. Additionally, some studies relied on self-reported measures of dietary adherence and lifestyle behaviors. Self-reported dietary intake is susceptible to recall bias and social desirability bias, which may affect the accuracy of the reported data. While many interventions demonstrated short-term improvements in glycemic control and metabolic outcomes, the long-term sustainability of these dietary interventions remains uncertain.

4.16 Application for Practitioner

For healthcare professionals, the findings emphasize the importance of incorporating structured dietary counseling and lifestyle education into routine diabetes care. Nutritional interventions should not be viewed solely as supportive therapies but rather as central components of diabetes management strategies aimed at addressing the underlying metabolic dysfunction associated with the disease. Healthcare practitioners should also consider adopting individualized dietary approaches based on patient preferences, cultural dietary practices, and metabolic needs. The diversity of dietary strategies shown to be effective in this review suggests multiple approaches may be suitable for different patient populations. Another important implication relates to early intervention. Evidence suggests individuals with preserved β-cell function and lower levels of insulin resistance are more likely to achieve remission when appropriate dietary interventions are implemented. Consequently, early diagnosis and timely initiation of lifestyle interventions may dramatically improve the likelihood of reversing metabolic dysfunction before irreversible pancreatic damage occurs. For policymakers and healthcare systems, the findings highlight the need to strengthen preventive and lifestyle-based diabetes management programs. Integrating structured nutrition therapy, behavioral counseling, and physical activity programs into primary healthcare systems may reduce the long-term burden of diabetes and decrease reliance on pharmacological treatment. Such strategies may also contribute to reducing healthcare costs associated with the long-term management of diabetes-related complications. In addition, the findings support the need for multidisciplinary approaches to diabetes management. Collaboration between healthcare professionals, including physicians, nurses, dietitians, physiotherapists, and behavioral health specialists, may improve patient outcomes by addressing the complex behavioral and metabolic factors associated with T2DM.

5. Conclusion

This review provides evidence dietary and lifestyle interventions play a fundamental role in improving metabolic outcomes in individuals with T2DM. Across the studies analyzed, intervention programs consistently resulted in improvements in glycemic control, insulin sensitivity, body weight, lipid profiles, and blood pressure. Importantly, several studies demonstrated intensive dietary interventions may ultimately lead to a reduction or remission of T2DM in a significant proportion of patients. Remission was associated with improvements in insulin sensitivity, reductions in hepatic insulin resistance, and preservation of pancreatic β-cell function. The findings may challenge the traditional perception of T2DM as an inevitably progressive disease and suggest metabolic dysfunction may be partially reversible through targeted lifestyle interventions. By addressing the underlying metabolic abnormalities associated with insulin resistance and β-cell dysfunction, the interventions may not only improve glycemic control but also reduce the long-term risk of cardiovascular and metabolic complications. Nevertheless, further research is needed to determine the longer-term effectiveness and comparative effectiveness of different dietary strategies. Future studies should focus on large-scale randomized controlled trials with extended follow-up periods to evaluate the durability of diabetes remission and identify the most effective dietary approaches for diverse patient populations. In conclusion, dietary and lifestyle interventions represent powerful therapeutic tools in the management of T2DM. When implemented early and supported by structured education and clinical monitoring, the interventions discussed have the potential to significantly improve metabolic health and, in some cases, achieve improvement or possible remission of the disease.

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Authors' contributions

EB and KH were responsible for the study design, and EB for data collection. EB drafted the manuscript, and KH revised drafts repeatedly. All authors read and approved the final manuscript.

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References

Academy of Nutrition and Dietetics. (2026). Evidence Analysis Library (EAL): Quality Criteria Checklist. Evidence Analysis Library. *Retrieve April 12, 2026* from https://www.andeal.org

Academy of Nutrition and Dietetics Evidence Analysis Library. (2022). *Evidence Analysis Manual: Steps in the Academy Evidence Analysis Process*. Academy of Nutrition and Dietetics

Al-Sahouri, A., Merrell, J., & Snelgrove, S. (2019). Barriers to good glycemic control levels and adherence to diabetes management plan in adults with type 2 diabetes in Jordan: A literature review. *Patient Preference and Adherence*, *13*, 675–693. https://doi.org/10.2147/PPA.S198828

American Diabetes Association Professional Practice Committee for Diabetes (2026). 9. Pharmacologic Approaches to Glycemic Treatment: Standards of Care in Diabetes-2026. *Diabetes care*, *49*(Supplement_1), S183–S215. https://doi.org/10.2337/dc26-S009

American Diabetes Association. (2023). Standards of medical care in diabetes—2023. *Diabetes Care*, *46*(Supplement_1), S1–S291. https://doi.org/10.2337/dc23-S001

American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD). (2022). Management of hyperglycemia in type 2 diabetes, 2022: A consensus report by the American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD). *Diabetes Care*, *45*(11), 2753–2786

Amsalu, H., Hailu, M., Asefa, A., Ayenew, M., & Yosef, T. (2024). The effect of lifestyle factors on chronic complications of diabetes at public health hospitals in Southwest Ethiopia. *Scientific Reports*, *14*(1), 18428.

Anyiam, O., Phillips, B., Quinn, K., Wilkinson, D., Smith, K., Atherton, P., & Idris, I. (2024). Metabolic effects of very-low calorie diet, Semaglutide, or combination of the two, in individuals with type 2 diabetes mellitus. *Clinical nutrition (Edinburgh, Scotland)*, *43*(8), 1907–1913. https://doi.org/10.1016/j.clnu.2024.06.034

Arokiasamy, P., Salvi, S., & Selvamani, Y. (2020). Global burden of diabetes mellitus. Handbook of global health, 1-44.

Aromataris, E.,Fernandez, R., Godfrey, C., Holly, C., Tungpunkom, P. (2015). Summarizing systematic reviews: methodological development, conduct, and reporting of an Umbrella review approach. *Int Journal of Evidenced Based Healthcare*. *13*(3):132-140

Aromataris, E., & Munn, Z. (Eds.). (2020). *JBI Manual for Evidence Synthesis*. Joanna Briggs Institute. https://synthesismanual.jbi.global).

Barrea, L., Verde, L., Colao, A., Mandarino, L. J., & Muscogiuri, G. (2025). Medical nutrition therapy for the management of type 2 diabetes mellitus. *Nature Reviews Endocrinology*, *21*(12), 769-782.

Buse, J. B., Wexler, D. J., Tsapas, A., Rossing, P., Mingrone, G., & Mathieu, C. (2020). 2019 update to: Management of hyperglycemia in type 2 diabetes, 2018. *Diabetologia*, *63*(2), 221–228. https://doi.org/10.1007/s00125-019-05039-w

Chiavetta, N. M., Martins, A. R., Henriques, I. C., & Fregni, F. (2014). Differences in methodological quality between positive and negative published clinical trials. *Journal of Advanced Nursing*, *70*(10), 2389-2403.

Chrvala, C. A., Sherr, D., & Lipman, R. D. (2016). Diabetes self-management education for adults with type 2 diabetes mellitus: A systematic review of the effect on glycemic control. *Patient Education and Counseling*, *99*(6), 926–943. https://doi.org/10.1016/j.pec.2015.11.003

Crasto, W., Patel, V., Davies, M. J., & Khunti, K. (2021). Prevention of microvascular complications of diabetes. *Endocrinology and metabolism clinics of North America*, *50*(3), 431-455.

Dansinger, M. L., Gleason, J. A., Maddalena, J., Asztalos, B. F., & Diffenderfer, M. R. (2025). Lifestyle Modification in Prediabetes and Diabetes: A Large Population Analysis. *Nutrients*, *17*(8), 1333. https://doi.org/10.3390/nu17081333

Davies, M. J., D'Alessio, D. A., Fradkin, J., Kernan, W. N., Mathieu, C., Mingrone, G., ... & Buse, J. B. (2018). Management of hyperglycemia in type 2 diabetes, 2018. *Diabetes Care*, *41*(12), 2669–2701. https://doi.org/10.2337/dci18-0033

Deledda, A., Palmas, V., Heidrich, V., Fosci, M., Lombardo, M., Cambarau, G., Lai, A., Melis, M., Loi, E., Loviselli, A., Manzin, A., & Velluzzi, F. (2022). Dynamics of Gut Microbiota and Clinical Variables after Ketogenic and Mediterranean Diets in Drug-Naïve Patients with Type 2 Diabetes Mellitus and Obesity. *Metabolites*, *12*(11), 1092. https://doi.org/10.3390/metabo12111092

Evert, A. B., Dennison, M., Gardner, C. D., Garvey, W. T., Lau, K. H. K., MacLeod, J., ... & Yancy Jr, W. S. (2019). Nutrition therapy for adults with diabetes or prediabetes: a consensus report. *Diabetes care*, *42*(5), 731.

Galicia-Garcia, U., Benito-Vicente, A., Jebari, S., Larrea-Sebal, A., Siddiqi, H., Uribe, K. B., ... & Martín, C. (2020). Pathophysiology of type 2 diabetes mellitus. *International journal of molecular sciences*, *21*(17), 6275.

Gower, B. A., Goss, A. M., Yurchishin, M. L., Deemer, S. E., Sunil, B., & Garvey, W. T. (2024). Effects of a carbohydrate-restricted diet on β-cell response in adults with type 2 diabetes: A eucaloric randomized controlled trial. *The Journal of Clinical Endocrinology & Metabolism*. Advance online publication. https://doi.org/10.1210/clinem/dgae670

Guo, L., Xi, Y., Jin, W., Yuan, H., Qin, G., Chen, S., Zhang, L., Liu, Y., Cheng, X., Liu, W., & Yu, D. (2024). A 5:2 Intermittent Fasting Meal Replacement Diet and Glycemic Control for Adults With Diabetes: The EARLY Randomized Clinical Trial. *JAMA network open*, *7*(6), e2416786. https://doi.org/10.1001/jamanetworkopen.2024.16786

Hall, J. E., do Carmo, J. M., da Silva, A. A., Wang, Z., & Hall, M. E. (2020). Obesity-induced hypertension: Interaction of neurohumoral and renal mechanisms. *Circulation Research*, *126*(7), 991–1006. https://doi.org/10.1161/CIRCRESAHA.119.315186

Hallberg, S. J., McKenzie, A. L., Williams, P. T., Bhanpuri, N. H., Peters, A. L., Campbell, W. W., ... & Volek, J. S. (2019). Effectiveness and safety of a novel care model for the management of type 2 diabetes at 1 year: An open-label, non-randomized, controlled study. *Diabetes Therapy*, *10*(2), 591–612. https://doi.org/10.1007/s13300-018-0574-3

International Diabetes Federation. (2021). *IDF diabetes atlas* (10th ed.).

Kahleova, H., Znayenko-Miller, T., Uribarri, J., Holubkov, R., & Barnard, N. D. (2023). Dietary advanced glycation products and their associations with insulin sensitivity and body weight: A 16-week randomized clinical trial. *Obesity science & practice*, *9*(3), 235-242.

Kanbour, S., Al-Mrabeh, A., Zhyzhneuskaya, S., Peters, C., Barnes, A. C., Melhem, S., Ashor, A., & Taylor, R. (2025). Impact of bodyweight loss on type 2 diabetes remission. *The Lancet Diabetes & Endocrinology*, *13*(4), 293–304. https://doi.org/10.1016/S2213-8587(24)00342-2

Lean, M. E. J., Leslie, W. S., Barnes, A. C., Brosnahan, N., Thom, G., McCombie, L., ... & Taylor, R. (2018). Primary care-led weight management for remission of type 2 diabetes (DiRECT): An open-label, cluster-randomised trial. *The Lancet*, *391*(10120), 541–551. https://doi.org/10.1016/S0140-6736(17)33102-1

Liu, Y., Chen, Y., Ma, J., Lin, J., Liu, C., Li, X., Xu, Y., Kuang, H., Shi, L., Xue, Y., Feng, B., Zhu, D., Wang, G., Yang, J., Xiao, X., Yu, X., Zhou, J., Bao, Y., Su, Q., … Li, X. (2025). Dapagliflozin plus calorie restriction for remission of type 2 diabetes: Multicentre, double-blind, randomised, placebo-controlled trial. *BMJ*, *388*, e081820. https://doi.org/10.1136/bmj-2024-081820

Lopes, G. S. G., Landeiro, M. J. L., Maciel, T., & Sousa, M. R. M. G. C. (2024). Clinical practice guidelines of foot care practice for patients with type 2 diabetes: A scoping review using a self-care model. *Contemporary Nurse*. https://doi.org/10.1080/10376178.2024.2362289

MacLeod, J., Franz, M. J., Handu, D., Gradwell, E., Brown, C., Evert, A., ... & Robinson, M. (2017). Academy of Nutrition and Dietetics nutrition practice guideline for type 1 and type 2 diabetes in adults: nutrition intervention evidence reviews and recommendations. *Journal of the Academy of Nutrition and Dietetics*, *117*(10), 1637-1658.

Mirahmadizadeh, A., Amiri, M., Bahrami, R., Arabi, Y., Seif, M., & Khosravizadeh, O. (2020). Adherence to medication, diet, and physical activity and the associated factors amongst patients with type 2 diabetes. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, *14*(6), 1581–1586. https://doi.org/10.1016/j.dsx.2020.07.037

Mohiuddin, G. S., Palaian, S., Shankar, P. R., Sam, K. G., & Kumar, M. (2019). Uncommon side effects of commonly used anti-diabetics: time to monitor them. *Int J Pharm Sci Res*, *10*, 4145-4148.

Moriconi, E., Camajani, E., Fabbri, A., Lenzi, A., & Caprio, M. (2021). Very-Low-Calorie Ketogenic Diet as a Safe and Valuable Tool for Long-Term Glycemic Management in Patients with Obesity and Type 2 Diabetes. *Nutrients*, *13*(3), 758. https://doi.org/10.3390/nu13030758

National Institute for Health and Care Excellence. (2026). *Type 2 diabetes in adults: management (NICE Guideline NG28)*

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... & Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, *372*, n71. https://doi.org/10.1136/bmj.n71

Palmer, S. C., Tendal, B., Mustafa, R. A., Vandvik, P. O., Li, S., Hao, Q., ... & Strippoli, G. F. (2021). Sodium-glucose cotransporter protein-2 (SGLT-2) inhibitors and glucagon-like peptide-1 (GLP-1) receptor agonists for type 2 diabetes: systematic review and network meta-analysis of randomised controlled trials. Bmj, 372.

Pandey, R. (2025). The Impact of Lifestyle Modifications on Glycemic Control in Type 2 Diabetes Patients: A Longitudinal Study. *European Journal of Cardiovascular Medicine*, *15*, 575-580.

Pavlou, V., Cienfuegos, S., Lin, S., Ezpeleta, M., Ready, K., Corapi, S., Wu, J., Lopez, J., Gabel, K., Tussing-Humphreys, L., Oddo, V. M., Alexandria, S. J., Sanchez, J., Unterman, T., Chow, L. S., Vidmar, A. P., & Varady, K. A. (2023). Effect of Time-Restricted Eating on Weight Loss in Adults With Type 2 Diabetes: A Randomized Clinical Trial. *JAMA network open*, *6*(10), e2339337. https://doi.org/10.1001/jamanetworkopen.2023.39337

Petersen, M. C., & Shulman, G. I. (2018). Mechanisms of insulin action and insulin resistance. *Physiological Reviews*, *98*(4), 2133–2223. https://doi.org/10.1152/physrev.00063.2017

Roncero-Ramos, I., Gutierrez-Mariscal, F. M., Gomez-Delgado, F., Villasanta-Gonzalez, A., Torres-Peña, J. D., Cruz-Ares, S., Rangel-Zuñiga, O. A., Luque, R. M., Ordovas, J. M., Delgado-Lista, J., Perez-Martinez, P., Camargo, A., Alcalá-Diaz, J. F., & Lopez-Miranda, J. (2021). Beta cell functionality and hepatic insulin resistance are major contributors to type 2 diabetes remission and starting pharmacological therapy: from CORDIOPREV randomized controlled trial. *Translational research : the journal of laboratory and clinical medicine*, *238*, 12–24. https://doi.org/10.1016/j.trsl.2021.07.001

Sun, H., Saeedi, P., Karuranga, S., Pinkepank, M., Ogurtsova, K., Duncan, B. B., ... & Magliano, D. J. (2022). IDF Diabetes Atlas: Global, regional and country-level diabetes prevalence estimates for 2021 and projections for 2045. *Diabetes research and clinical practice*, *183*, 109119.

Taylor, R. (2019). Calorie restriction and reversal of type 2 diabetes. *Cell Metabolism*, *29*(4), 731–732. https://doi.org/10.1016/j.cmet.2019.03.001

Van den Burg, E. L., van den Peet, P. G., Ketel, I., Kieneker, L. M., de Groot, M., de Koning, E. J. P., & Hulsman, A. C. (2024). Integration of a fasting-mimicking diet programme in primary care for patients with type 2 diabetes reduces the need for medication and improves glycaemic control: A 12-month randomised controlled trial. *Diabetologia*, *67*(7), 1245–1259. https://doi.org/10.1007/s00125-024-06137-0

Varady, K. A., Cienfuegos, S., Ezpeleta, M., & Gabel, K. (2022). Clinical application of intermittent fasting for weight loss and metabolic health. *Nature Reviews Endocrinology*, *18*(5), 309–321. https://doi.org/10.1038/s41574-022-00638-x

Velázquez-López, L., Segura Cid Del Prado, P., Colín-Ramírez, E., Muñz-Torres, A. V., & Escobedo-de la Peña, J. (2022). Adherence to non-pharmacological treatment is associated with the goals of cardiovascular control and better eating habits in Mexican patients with type 2 diabetes mellitus. La adherencia al tratamiento no farmacológico se asocia con metas de control cardiovascular y mejores hábitos dietéticos en pacientes mexicanos con diabetes mellitus tipo 2. *Clinica e investigacion en arteriosclerosis: publicacion oficial de la Sociedad Espanola de Arteriosclerosis*, *34*(2), 88–96. https://doi.org/10.1016/j.arteri.2021.03.005

Wang, H., Chen, F., Zhang, Q., Chen, J., Zhang, W., Fang, L., & Xiong, P. (2025). Evidence-Based Synthesis for Practice: Lifestyle Interventions in Type 2 Diabetes with

Obesity. Diabetes, Metabolic Syndrome and Obesity, 3671-3686.

World Health Organization. (2025). *WHO guidelines on the use of glucagon-like peptide-1 (GLP - 1) receptor agonist for the treatment of obesity*. Geneva: WHO

World Health Organization. (November, 2024). Diabetes. Retrieved from https://www.who.int/news-room/fact sheets/detail/diabetes#:~:text=In%202021%2C%20diabetes%20and%20kidney,screening%20and%20treatment%20for%20complications.

World Health Organization. (2021). Diabetes. https://www.who.int/news-room/fact-sheets/detail/diabetes

Yan, Y., et al. (2025). Effectiveness of low-carbohydrate diets on glycemic control in type 2 diabetes: A systematic review and meta-analysis. *Diabetology & Metabolic Syndrome*.